ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 19, No. 17. WEEKLY. | NEW YORK, SATURDAY, DECEMBER 19, 1891. | $3 per Annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

Professor Elihu Thomson keeps a big basket of apples on the library table in his office at Lynn, Mass. Hungry callers are supposed to help themselves. The apples come from Professor Thomson's Swampscott estate.

The Thomson-Houston Electric Company is preparing to give the public something more to talk about in the way of electric locomotives. Next week they will commence work on a new passenger locomotive which is expected to develop a speed of 40 miles per hour. The designs show a handsome closed car with quiet a different truck construction from the ordinary. It will have 6,000 pounds draw-bar pull, will weigh 16 tons, and be of 250 horse-power.

The Schenectady, N. Y., police have arrested three workmen in the Edison General Electric Company's factory for stealing small motors. The machines were carried home at night in pieces in the men's pockets. The parts were then assembled and the motors shipped to confederates in New York who disposed of them.

In India the Great Peninsular Railroad is using old rails for telegraph poles. Two rails are bolted together so as to make a pole sufficiently high. When thus equipped a line presents a very neat appearance, is in little danger of being rendered useless by high winds and is comparatively cheap.

The barn festival and dance given in the new stock barn of Mrs. H. McK. Twombley, at Madison, N. J., is a matter of interest because of the electric decorations that were used. Mrs. Twombley had erected for the purpose a temporary 1,000 incandescent light plant. The steam was supplied from two 60 horse-power boilers to a 90 horse-power engine belted to two 500-light Edison dynamos. The lights were artistically arranged all over the barn and the paths leading to it, and the effect obtained was extremely beautiful.

Alderman Garrett's resolution not to venture on an electric car has been broken. It happened in this wise. He wanted to visit North Lebanon, and the friend who accompanied him offered to pay his fare. The portly alderman sat in the corner of the car, and his friend sat by the stove. When they reached their destination and got out, the alderman complained of feeling cold. His friend said, "why didn't you sit closer to the stove?" "Was that thing a stove?" questioned the innocent alderman, in reply. "I thought it was a motor." On their return each occupied a position on either side of the stove. The alderman says it goes "real nice," and if any one invites him he "may try it again."—*Lebanon, Pa., Report.*

"We are doing a great deal of new underground work in Pittsburgh," said Morris W. Mead, Chief of the Bureau of Electricity. "The city and the telephone company are working together in the matter. Vitrified clay tiles laid in cement are being used. I think that with such a conduit it might be possible to use cables without lead covering."

Electrical Works of O. L. Kummer & Company, Dresden.

The main works of this firm are at Niedersedlitz, near Dresden. The firm began to build electrical apparatus in 1880, and at present have a large trade with the German government for fitting out war vessels with lighting and power apparatus and steam dynamos for lighting trains by electricity. The arc lamps, automatic regulators and cut-outs, are of especial interest. Up to July 1 of the present year 275 dynamos and 154 steam dynamos have been manufactured by this firm, as well as 136 electric motors, with a total of 4,320 effective horse-power, besides 835 arc lamps and 26,500 incandescent lamps.

Their four-pole machine, "Epsilon," has a total capacity of 13,400 watts at 110 volts, when driven by belting at high speed; while the same machine, directly coupled to a steam engine making 500 revolutions per minute, generates a current of 3,350 watts.

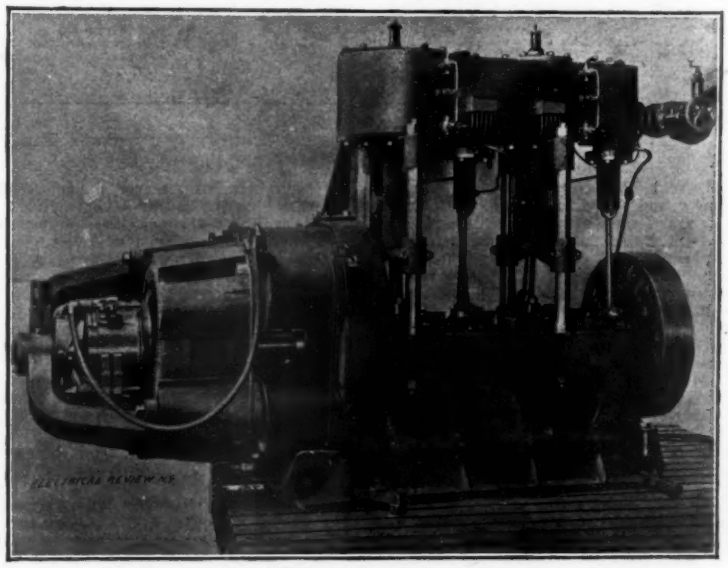


FIG. 1.—COMPOUND STEAM DYNAMO, BUILT BY O. L. KUMMER & COMPANY, DRESDEN.

The total weight of engine and dynamo is 470 kilogrammes.

Compound steam dynamos are also built by this firm, and of different speeds, for ship lighting and train lighting. This apparatus has a capacity of 25,000 watts at 250 revolutions per minute, and 40,000 watts at 400 revolutions per minute. At the Exposition at Frankfort one of these steam dynamos was used to charge a battery of accumulators of the Electricitats Maatschapplj system. The charging current was 160 amperes at 160 volts, and incandescent lamps of the same firm (De Khotinsky lamps) were being operated from the same battery during charging. The dimensions of this vertical compound engine are: Diameter of high pressure cylinders, 240 millimetres; diameter of low pressure cylinders, 385 millimetres; stroke, 225 millimetres. The normal speed of the engine is 400 revolutions at six atmospheres pressure, at which speed 61 effective horse-power are developed. The engine is equipped with a quick acting regulator of peculiar design. A detailed description is unnecessary, as its principle of operation is similar to those in general practice. The dynamometers employed are very effective, durable and give good satisfaction. The speed of this particular one is 30 metres per second and measures power up to 24 horse-power. The arc lamps are built for series and parallel circuits, and constructed with shunt and differential windings. The designs for interior lighting are very neat, burn very steady and give absolutely no trouble whatever. This is the experience of several consumers using these lamps who were questioned concerning them. Fig. 2 shows a Gleichstrom transformer built for use in charging storage cells.

FRANK C. PERKINS.

Kind Words from a Highly Esteemed Contemporary.

The annual election of the Press Club was held last week, when the regular ticket was triumphantly elected by about two to one. The second name on the ticket was that of Mr. Chas. W. Price, Editor of the ELECTRICAL REVIEW, who was nominated as vice-president. The compliment thus paid to the electrical press is a high one, and it is general cause for congratulation that the honor has been so well bestowed. Mr. Price has probably as large an acquaintance in journalism as he has in the electrical field, and that his qualities are equally appreciated in both spheres of activity is seen in the fact that he is also at the present time one of the vice-presidents of the Electric Club. Mr. Price enters upon his new duties at an interesting period, as it is the intention of the Press Club to push forward vigorously in the increase of membership and in the building of a fine Club House, in the vicinity of Printing House Square. It is understood that Mr. Price will continue his active and successful work as secretary of the International League of Press Clubs. The general idea of a clubman is that of a being to whom selfish indulgence in *dolce far niente* is the chief end of existence. Mr. Price may be pointed to as an exemplar of the other kind of clubman, who believes that the club may be made to play a great part in promoting intercourse and friendship, and who is willing to sacrifice his time and money freely in making the club the center of all that is brightest and best.—*The Electrical Engineer.*

The Milwaukee Telephone System.

Within a short time the telephone exchange at Milwaukee, Wis., will have a new home. The circuits are to be made metallic and the system otherwise improved.

A year ago two pair of wires were strung as far as Waukesha under these conditions, and they have been extended to Appleton, giving the people up there direct connection with the long-distance line to Chicago. Racine and Milwaukee are also connected by the same system. By the use of the modern switchboard, Appleton and Chicago can be connected as quickly as a connection can be made between two points in the same town.

About $400,000 has already been expended in subway work. The subways built in 1889 contain 875 miles of wire. The underground work now in progress will bury about 2,056 miles, including submarine cables. This will make a total of 2,931 miles of new copper wire in the subways. Of these about 2,000 miles will be actively employed, the balance having been placed there to accommodate future growth. These figures do not include the ærial wires used for connections.

The work of connecting all these wires with the new $40,000 switchboard is no small job, as it required the labor of 20 men for 60 days in making 120,000 solid connections between the cable heads and the subscribers' spring jacks on the switchboard. The switchboard, as at present arranged, has a capacity for 2,400 subscribers, with an ultimate capacity of 4,000.

The connection between the subway cables and the switchboard requires 264 miles of wire, with 47 soldered connections for each subscriber's line.

The average cost for installing each subscriber into the new metallic circuit exchange will represent an actual outlay to the company of $167. This includes the wire and terminal facilities necessary to furnish metallic circuit service. If dead capital were reckoned in the calculation, the cost would be $185 for each subscriber.

The Wisconsin Telephone Company extends its wires into what are called 40 radii, each within 15 miles of an exchange. There are in the State 80 exchanges and 190 toll stations. Besides these, the company has 350 contracts for private lines and speaking tubes, not in connection with exchanges.

There are 6,300 miles of wire in the air within the limits of the exchanges, besides 2,700 miles of toll line in addition, carrying 3,500 miles of wire operated on the ground circuit system.

There are 410 persons of all classes employed by the company to attend to the wants of 6,820 subscribers. Of this number 2,450 reside in Milwaukee, and 3,370 in the rest of the State. The toll messages transmitted annually run up to 176,000 in number.

The building which the Wisconsin Telephone Company has erected on Broadway is a model for the two purposes for which it was put up. The first consideration was to erect a central office that would be as near fireproof as possible.

The second consideration in erecting a permanent home for the exchange was to make it as comfortable as possible for the officers and employés who are to inhabit it. This work has also been performed as successfully as was the labor of getting up a building that would not burn. The building represents an outlay of between $75,000 and $80,000, and it is constructed so as to guard against both exterior and interior fires. It is five stories high, with a terra-cotta front

that presents a neat and novel appearance. The interior is solid brick and steel, with iron stairways, marble wainscot and mosaic floor for the first two stories. It is really two buildings in one, with a spiral stairway occupying the court. The front building is for offices and the rear one for operating rooms and storage purposes.

On the first floor, at the entrance, is the room where Superintendent Parker will preside. Immediately at the rear, and connected by a door, W. H. Hyde, superintendent of equipment, will have his room and direct the work of his department.

The rear of this floor will be occupied by the storekeeper's room and the inspector's department.

Ascending the marble stairs to the second floor, and facing west, the visitor will find himself in a neat little ante-room, leading into the office of President Payne, whose quarters have a mosaic floor, mahogany wainscot and a handsome fireplace. The room occupies the entire front of the building. A door on the right side opens into the directors' room at the rear. Adjoining this room is a snug little office which Secretary McLeod will occupy. The rear of the second floor contains a private office for Auditor Cottrill and a general office for the clerks.

The third floor contains the office described above, together with a lot of rooms to be used by the custodian of the building.

On the fourth floor the fair sex will reign supreme. In front there is a sitting-room of the same size as the president's office, handsomely wainscotted in oak. Connected with it is a room where there will be sofas for girls who have time to rest when there is a lull of business at night. There is also a cloak-room, with lockers for every two girls. Washrooms, etc., occupy the rest of the space. A matron will preside over this section of the building, and will furnish coffee and lunch to those girls who are prevented from going home to meals by either distance or weather.

The rear half of the floor is used for the operating room, where the multiple switchboard and a corps of nimble-fingered and quick-eared girls keep the conversation of the city in motion.

The long distance and toll lines also run into this room, and are managed by two women.

The fifth floor will be used for the stationery department.

The basement of the building is used for the reception of the cables, which are properly arranged and numbered, and are so placed that one can be taken out without disturbing the rest. There is room in the basement for 72 cables, not over half of which number is needed at present.

The conduits which the Telephone Company puts in for its underground service are made of vitrified clay, ten inches square, with a shelf in the center, thus dividing them into two chambers. They have a carrying capacity of six cables, and will thus accommodate between 500 and 600 subscribers on each line of conduit. They are buried two feet underground and have a manhole at the end of each block. Near this manhole a pole stands carrying a pipe in which are the wires which connect subscribers in the immediate neighborhood.

Current is furnished to the exchange from a storage battery plant.

The officers of the Wisconsin Telephone Company are: Henry C. Payne, president; C. H. Haskins, vice-president; John D. McLeod, secretary; F. G. Bigelow, treasurer; Frank E. Parker, superintendent; E. B. Cottrill, auditor.

A Big Ammeter.

The Weston Electrical Instrument Company, Newark, N. J., has taken a contract to build a 5,000 ampere ammeter for the Willson Aluminum Company, of Leaksville, N. C. This instrument is to be a very large form of the well known Weston type of ammeter, with some important modifications to meet the peculiar requirements of the case. It will have a scale about 14 inches long, which will be divided into 250 parts. Each division will equal 20 amperes and the divisions will be large enough to be easily read to tenths or two amperes, and with care to one ampere. The scale will be laid out by actual calibration to the full current to be measured by the instrument in practical work, namely, 5,000 amperes.

This may seem a considerable undertaking, especially when we consider the work which is commonly done by the use of a current of 5,000 amperes. Thus in incandescent lighting with the direct current, each 16 candle-power lamp requires about .5 ampere. The current required to standardize this instrument would, therefore, run 10,000 incandescent lamps. But in the company's plant the copper conductors in the laboratory for handling ammeter work weigh about four tons, and that some of the mains have a sectional area of five square inches, and are capable of carrying a current of 10,000 amperes without inconvenient heating.

Storage Battery Manufacture is Now a Monopoly.

When Judge Coxe decided last June, in the case of the Brush Electric Company *vs.* The Accumulator Company, that the fundamental storage battery patents were the property of Mr. Charles F. Brush, an injunction might have been expected to issue within a week. But, owing to the peculiar nature of the case and the interests at stake, a stay was granted.

At Utica, N. Y., December 1, Judge Coxe decided to issue the injunction which follows:

The President of the United States to The Electrical Accumulator Company, Theodore N. Vail and O. E. Madden, Greeting:

WHEREAS, it has been represented to us in our Circuit Court of the United States for the Second Circuit and the Southern District of New York that letters patent of the United States were issued in due form of law, on March 2, 1886, numbered 337,299, to Charles F. Brush for secondary battery, and on October 17, 1882, numbered 266,090, to Charles F. Brush for secondary, and that you, the said, The Electrical Accumulator Company, Theodore N. Vail and O. E. Madden, have infringed the rights secured by the aforesaid letters patent by manufacturing, making, using and selling to others secondary batteries made in accordance with and in infringement of claims 1, 2, 3, 6, 7 and 12 of said letters patent numbered 337,299, and of claims 7 and 14 of said letters patent numbered 266,090, contrary to the form of the statute in such case made and provided.

NOW, THEREFORE, WE DO STRICTLY COMMAND AND PERPETUALLY ENJOIN YOU,

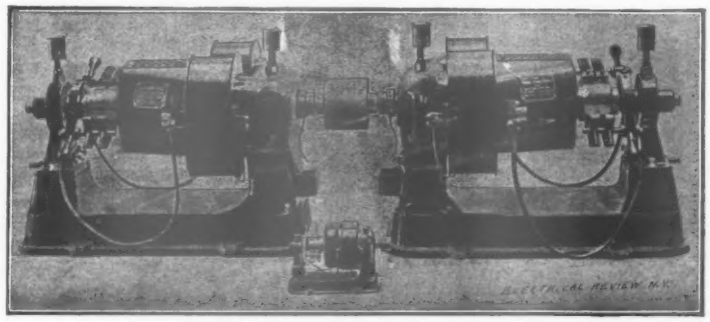


FIG. 2.—KUMMER'S DIRECT CURRENT-DIRECT CURRENT TRANSFORMER, FOR CHARGING ACCUMULATORS.—(See first page.)

the said The Electrical Accumulator Company, and Theodore N. Vail and O. E. Madden, and each of you, under the pains and penalties that may fall upon you, and each of you, in case of disobedience, that you do absolutely desist and refrain from any construction, sale or use, in any manner, of any patented improvements in processes of making secondary batteries and secondary battery elements, or any part thereof, in accordance with or in infringement of the aforesaid claims of the said two letters patent.

WITNESS: The Honorable Melville W. Fuller, chief justice of the Supreme Court of the United States, at the City of New York, the second day of December, one thousand eight hundred and ninety-one.

JOHN A. SHIELDS,
[SEAL.] *Clerk.*

Solicitors for complainant,
WITTER & KENYON.

This throws the monopoly of storage battery manufacture for nearly 12 years to come into the hands of the Consolidated Electric Storage Company, of this city and Philadelphia.

The Electrical Accumulator Company took an appeal in the case to the recently formed Circuit Court of Appeals.

The Electrical Accumulator Company was wound up about a year and a half ago, and was succeeded by the Accumulator Company of New Jersey, so that it became necessary to proceed against that company to stop it from making, using or selling storage batteries.

An application was made last week before Judge Green of the United States Circuit Court, in New Jersey, and as a consequence, the following order was awarded.

It is very unusual in an application for a preliminary injunction to grant a restraining order, but the litigation had become so protracted and expensive that once a perpetual injunction had been awarded to the plaintiffs, the circuit court of New Jersey felt constrained to grant a restraining order pending the return of the order to show cause.

The Brush patents are now controlled by the Consolidated Electric Storage Company, who thereby become the only persons in this country who can legally make, use or sell practical storage batteries.

At a stated term of the Circuit Court of the United States for the District of New Jersey, at Trenton, New Jersey, on the eleventh day of December, 1891.

Present, Hon. Edward T. Green, Judge.

The Brush Electric Company and the Consolidated Electric Storage Company *vs.* the Accumulator Company, Joseph D. Potts, its president, *pro tem.*, and W. W. Griscom, its vice-president, *pro tem.*—In equity.

The Court having duly considered the bill of complaint in the above entitled suit, the affidavits of William Bracken, C. F. Brackett, Pedro G. Salom, Henry G. Morris and John H. Halloway, and the exhibits referred to in said affidavits, and it appearing that the complainants are in danger of irreparable injury in case a restraining order is not issued, now, on motion of Witter & Kenyon, solicitors for complainant, it is hereby

Ordered, This eleventh day of December, 1891, that the defendants, the Accumulator Company, Joseph D. Potts, its president, *pro tem.*, and W. W. Griscom, its vice-president, *pro tem.*, show cause, if any they have, before me on the seventh day of January, 1892, at eleven o'clock in the forenoon of that day, or as soon thereafter as counsel can be heard, why an injunction *pendente lite* should not issue pursuant to the prayer of the bill, and it appearing that the bond, a copy of which is hereto annexed, has been filed with the clerk, it is further

Ordered, That the said defendants, the Accumulator Company, Joseph D. Potts, its president, *pro tem.*, and W. W. Griscom, its vice president, *pro tem.*, and their and each of their associates, servants, agents, employés, workmen and all others acting for, with or under them or either of them, be restrained and prohibited until the hearing of the above order to show cause and the determination of the same and the order of this Court thereon, from directly or indirectly making, using, preparing, selling or disposing of any secondary or storage batteries embodying the inventions or either of them covered in or by claims 1, 2, 3, 6, 7, 12 of letters patent of the United States to Charles F. Brush, dated March 2, 1886, and numbered 337,299, or in or by claims 7 and 14 of letters patent to said Brush dated October 17, 1882, and numbered 266,090, or from in this or any other way infringing upon the rights of the complainants in this behalf. This restraining order and the order to show cause to take effect upon the service on the defendant, the Accumulator Company, or either of its above-named officers, Potts or Griscom, of a copy of this order and a copy of the bill of complaint and of the affidavits referred to herein.

The exhibit batteries referred to in the papers can be seen at the office of the clerk of this Court until the hearing of this motion. (Signed) EDW. T. GREEN.

New England Electric Club.

It is reported from Boston that a New England Electric Club is to be formed to take the place of the Boston Electric Club.

New York Electric Club.

The Club will hold its next meeting on New Year's Eve. Joseph Howard, Jr., the well-known newspaper man, will deliver the address of the evening. Mr. Howard is a member of the Club, and his co-members always exhibit a true appreciation of his wit, humor and patriotism, when it comes his turn to speak. Dr. Wangemann will have charge of the musical part of the programme. The Club punch bowl will be filled and emptied several times.

Herr Carl Engelhard, of Hanau, Germany, was the guest of Mr. C. O. Baker, Jr., last week.

On the Determination of Electric Current Curves.

BY DR. O. FROLICH.

Electrical engineering has long since arrived at the stage at which it became desirable to ascertain the form of the curves determined by the relation between the current and the time in various cases. The first instances in which this necessity arose occurred in connection with telegraphing on long cables or circuits of large capacity; more recently the influence of self-induction and capacity on alternating current practice has come to the front.

The slowly moving curves, such as were met with in cable telegraphy, were directly recorded by well-known apparatus, such as Sir William Thomson's syphon recorder and Siemens & Halske's soot writer; for the quickly moving curves, such as are found with alternating currents, these instruments are too slow, and apparatus has had to be used with which we can measure the current at stated intervals and then set out the curve from the measurements so obtained. Although this method gives accurate results, it does not supply the want felt by engineers when carrying out experiments; for this purpose some arrangement is required which will at once exhibit the curve as it is produced, so that any alteration made in the apparatus can be observed immediately on the curve, and the latter can be recorded in a simple and practical manner.

This problem is similar to that which occurs in registering sounds, and it is accordingly only natural that we should first investigate the methods which have been successfully applied in this case. The best known of these is that of Lissajous, which was also frequently adopted by von Helmholtz in his experiments on sound. After having worked for some time on these lines and arrived at certain results, the method was abandoned, inasmuch as it gives, not the actual curve, but its development on a cylindrical sleeve, and because, consequently, the various portions are not set out with equal accuracy. In such experiments the bodies from which the curve is to be obtained must undergo a motion of the nature of such a vibration as occurs in a tuning-fork. For electrical curves a telephone, on the membrane of which a mirror was fixed eccentrically (*i. e.*, between the center and the circumference), was used with success, the current which was to be investigated being allowed to circulate in the coils.

When a telephone thus arranged was used in combination with a rotating mirror, such as is often used in physical experiments, and a powerful beam of light, after reflection at the telephone and the revolving mirror, allowed to fall on a screen, the required curve was at once obtained in a form readily observed. Since, however, this curve was not at rest, but moving over the screen, it was not possible to examine it with the necessary accuracy. In order to bring its oscillations to a fixed position on the screen, *the two motions, that of the rotating mirror and that of the telephone membrane, must be combined in a definite manner.* If the apparatus was so arranged that one electric oscillation, *i. e.*, one movement backwards and forwards, of the membrane corresponded exactly with one revolution of the rotating mirror, and the latter contains only one reflecting surface, a part only of the curve, though *fixed in position*, was obtained, the beam at each passage over the screen tracing the same curve at the same spot, and the illuminated curve appearing stationary when the motion was rapid. In order to arrive at this result the movements of mirror and telephone must be performed in time with one another.

In order to obtain the whole of the curve, and of such a magnitude as would be convenient for photographing, for instance, and also to get it repeated as often as possible, the rotating mirror was provided with a number of reflecting surfaces, and the proportion between the number of mirrors passing and the period of electric oscillation rigidly fixed. A series of rapidly succeeding illuminated curves was then obtained in the

same place on the screen, and these could easily be observed, examined and photographed.

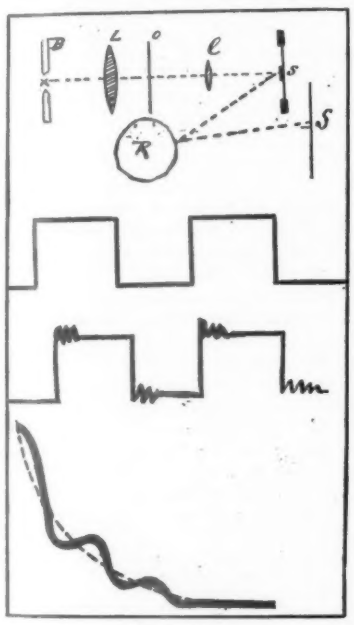
This arrangement also possesses the great advantage that the process of production is *independent of the speed* of the mirror and the electric oscillation; the wave length of the image remains constant. In this way, then, the effect of an alteration in the current period on an electric curve may easily be observed, and the process may readily be applied in the case of long cable telegraphy, induction coils, alternators, etc.

As a source of light a powerful arc lamp was used, and in order to obtain a parallel beam of somewhat small section, the ordinary combination of lenses was adopted. Fig. 1 shows the optical arrangements. B, arc lamp; L, lenses; *o*, screen with small aperture; *s*, telephone with mirror; R, revolving mirror; S, screen on which are thrown the images of the curves.

The revolving mirror was provided with 12 silvered reflectors, and a special device was adopted in order to bring these parallel to the vertical axis of rotation and at equal angles to each other. The mirror was fixed to a gear-wheel, driven off the spindle of a small alternating motor; for investigation with direct currents, a commutator such as is used on small dynamos was fixed to the motor spindle.

The proportions were ordinarily so chosen that the wave length on the screen came out at about 12cm., and the amplitude 6cm. In a darkened room an audience of 200 persons could then see the curve without leaving their places. When photographs were to be taken, a camera with a plate was used instead of the screen.

The curves given by this apparatus do not necessarily correspond to the current in the telephone coils, but to the movements of the membrane actuated by it. In order that the former curve may coincide with that which



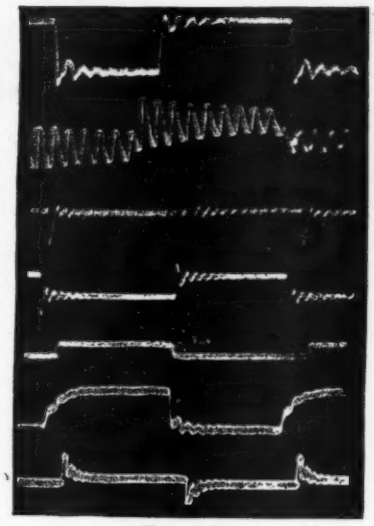
FIGS. 1–4.

we wish to investigate, a membrane must be obtained which shall reproduce as accurately as possible the current curve. This desideratum, however, also enters into the production of a good telephone, and consequently we cannot do better than use an ordinary telephone membrane.

I found from my experiments and the theory that every membrane acts like a damped pendulum, the motion of the membrane taking place in accordance with its proper period of vibration and the damping force, as well as with the alterations in the current. We can determine the two former values for a given membrane by opening and closing, at regular intervals, a circuit passing through the telephone, an inductionless resistance, and a set of accumulators. The current curve must in this case be that given in Fig. 2 (second in order in diagram); the telephone, however, gives us that in Fig. 3. From a comparison of the two, the two constants of the membrane, namely, its period and the damping, can be ascertained. When these are known, any curve of the current flowing through the telephone can be deduced from that produced by our method by means of a graphic construction.

It is only in the case of sudden alterations in the current that any considerable difference between the current curve and the membrane curve arises. When the changes take place comparatively slowly, as in an ordinary sine curve, the observed curve gives that of the current sufficiently exactly. Practically, then, the curve need only be corrected in the case of sudden current changes, when the effect of the period of the membrane becomes marked, and then a mean curve is drawn taking these vibrations into consideration (see Fig. 4). In most cases this is sufficient.

We give some of the curves obtained with the apparatus. The figures are reproductions of the original photographs. Figs. 5 to 11 are battery curves, such as are obtained on switching on and off a battery working on an external circuit. When the battery is opened the external circuit is simultaneously closed. The time of each current impulse is about $\frac{1}{10}$ of a second.



FIGS. 5–11.

Fig. 5 is produced when the external circuit is practically free from self-induction. The influence of the vibration period of the ordinary telephone membrane is here distinctly perceptible.

In obtaining Fig. 6 the membrane was replaced by a cardboard disk, to which was attached a small piece of thin sheet iron. The vibrations due to the proper period of the membrane are here much stronger than with the ordinary membrane, and it is difficult to make out the real current curve. Since the card membrane gives a bad representation of the current curve, it must also, when used in a telephone, give a bad reproduction of speech. This was confirmed by a direct experiment.

Fig. 7 shows the charge and discharge of a condensor, the circuit being almost free from resistance.

Figs. 8 and 9 give the current curve at the beginning and the end of a small cable, current impulses being taken from a battery. The former shows clearly the charging and discharging of the cable; the latter is smaller, and is apparently free from indications of charge.

Figs. 10 and 11 show the current in the primary and secondary windings of a transformer without an iron core. The retarding influence of self-induction when the current changes makes itself felt.

The curves in Figs. 12 to 17 were obtained with a small Siemens alternator. In Figs. 12 and 13 a resistance almost without self-induction was placed in the external circuit. In Fig. 12 the armature producing the current consisted of wire only. In Fig. 13 an iron core was used in the armature.

It is obvious that these curves differ considerably from a sine curve. The rise and fall are different, and the use of iron produces secondary maxima and minima.

Figs. 14 and 15 show curves obtained on circuits of the same resistance, self-induction being provided in the former case by means of an electro-magnet, the latter being without such self-induction. The amplitude and mean current in the former case are clearly smaller.

Figs. 16 and 17 show the difference in phase in two external circuits in parallel, self-induction being put in in the one circuit only. The black band in the two curves is the shadow of a rod that was attached to the screen on which the images were produced in order to arrive at a fixed time mark. In one curve the mark falls by chance at the maximum of a wave, whilst in the other it is a quarter of a wave length to the right. I may here remark that the determination in this manner of the phase difference in alternating currents, wherever an iron core exists, gives results quite different from those to be expected from theoretical considerations.

From the foregoing examples it appears that this method is well fitted for obtaining reproductions of any desired current curves in a direct manner; and in particular it seems to call for some new explanation of the behavior of alternating currents, in investigating which hitherto one has been compelled to be satisfied, even in experiments, with taking mean values for the electrical quantities. The above investigations were conducted at Messrs. Siemens' and Halske's laboratory in Berlin (*vide Electrotechnischer Zeitschrift*, 1889, page 345).

A Costly Cablegram.

A South American journalist at present in this city tells the following story of Sarah Bernhardt while she was on a visit to South America in 1883.

"I was translator," he says, "for the press news received in Valparaiso by the newspaper *Le Union*. The manager had just brought the morning's cablegrams as I was leaving the house, and I read with great surprise the story of Maurice Bernhardt's famous duel with the French painter, M. Langlois, who had exhibited a caricature of Sarah. M. Langlois had been wounded.

"I immediately proceeded to the Hotel Colon and inquired for the actress. She was asleep. I went back to the office and with the aid of a dictionary I got up a rather nice letter in French, inclosing the cablegram, not forgetting to congratulate her on the courage of her son and his apparently bloodless escape. I was summoned to the hotel and closely questioned as to its genuineness. I explained to the actress that all cablegrams were not written in the office and that the one she had was surely an 18 carat article.

"Then in her anxiety she feared I was withholding something—perhaps some news of Maurice having also been injured. When I assured her of my good faith, her tenderness of expression to the son she loved was very touching. They were no artificial efforts of a great actress. They were the genuine sentiments, a loving mother weeping tears of joy for the boy who had avenged his mother's honor.

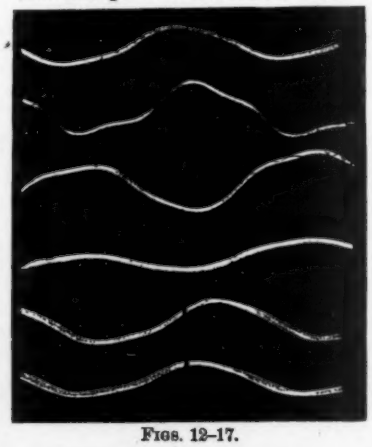
"Finally, she bent her eyes on me with a look of sweetness, and, giving me her hand, said: 'Ah, Monsieur, how am I to thank you for your great kindness in bringing me the good news?' Then, as if moved by a sudden impulse, she sprang up and exclaimed: 'But what are we doing here? My dear Maurice must have a cablegram. Let us to the office. At once! Away!' And while I was arranging my hat Sarah was dressed for the street.

"We got to the cable office and Sarah sat down and wrote out lengthily. The manager suggested that she should use the code. With an imperious gesture she ordered him to be silent. He ventured an apology.

"'Monsieur,' she said, 'this is no time to think of economy. To save money under these circumstances would be a crime—ah, what is money?' And her scorn was ineffable. When the receiver had counted the words he told her the price of the cablegram would be $288.20. She paid it as if it were only a dime.

"Upon returning to the hotel, M. Kerbernhardt said to her, laughingly: 'But, Sarah, you have not thanked M. Max in the proper manner.'

"'Ah!' exclaimed Sarah, 'but I will'; and taking my face between her hands she said, while kissing me on either cheek: 'There is



FIGS. 12–17.

one for yourself and one for your paper.' I regretted when she had done. She recalled the incident when I saw her an evening or two since in this city between the acts at the Standard Theatre."—*New York Press.*

The municipal plant now being installed by the Heisler Electric Company at West Toronto Junction, Ontario, Canada, is nearing completion, and the lights will be in operation shortly.

Portland, Ore.—Patton Motor Company; capital, $50,000.

Bangor, Me.—Electric Heat Alarm Company; capital, $25,000.

Malvern, Ia.—Malvern Light and Power Company; capital, $10,000.

Newark, N. J.—The Safety Electrical Company; capital, $25,000.

Portland, Me.—Italian Motor and Power Company; capital, $500,000.

Litchfield, Ill.—Litchfield Light, Heat and Power Company; capital, $50,000.

New York.—The Wilder Duplex Electric Alarm Company; capital, $500,000.

Astoria, Ore.—Astoria District Messenger and Electric Company; capital, $30,000.

Portland, Me.—New England Heat Regulator and Electric Company; capital, $50,000.

Omaha, Neb.—Metropolitan Street Lighting Company; capital, $25,000. Promoters, George F. Sternsdorf and George E. Specht, of Omaha.

Chicago, Ill.—Mosher Arc Lamp and Manufacturing Company; capital, $25,000. Promoters, J. M. Fisher, J. A. Mosher and G. W. Carpenter.

Beatrice, Neb.—Beatrice Light and Power Company; capital, $250,000. Promoters, Ed. P. Maxwell, F. J. Maxwell and William Pickrell.

San Diego, Cal.—The San Diego Electric Railway Company; capital, $250,000. Promoters, J. D. Spreckels, A. B. Spreckels, E. S. Babcock, Charles T. Hinde and Joseph A. Flint.

New Brighton, Pa.—Home Electric Company; capital, $10,000. Promoters, John H. Williams, L. R. Strobridge, W. A. Coventry and J. F. Mitchell, of New Brighton, and N. N. Davidson, of Beaver.

Dallas, Tex.—The Southern Improvement Company; capital, $60,000. Promoters, J. H. Bennett, W. J. Williams, C. J. Baldwin, O. J. Gorman. Incorporation papers sent to W. J. Williams, Dallas, Tex.

New York.—The State Electric Light and Power Company of the State of New York; capital, $200,000. Promoters, Noah L. Cocheu, L. R. Stegman, Philip F. Lenhart, Franklin Coit and Garrett C. Hallenbacke, all of Brooklyn, N. Y.

Spokane, Wash.—Hudson Land Company; capital, $50,000. Promoters, Theo. Reed, A. McKinzie, E. M. Cheadle, Fred. Flint, C. B. Denning, H. M. Casey, Chas. Jasper, of Spokane, and P. W. Lawrence and J. H. McCabe, of Garfield, Wash.

New York City.—U. S. Portelectric Company; capital, $5,000,000. Promoters, Thos. L. James, John Straiton, A. J. Dittenhoefer, C. F. James, Percival Knauth, William James, John T. Williams, Henry Huss, Frank Lawton, Whipple V. Phillips.

Owatonna, Minn. — Owatonna Electric Company; capital, $25,000. Promoters, H. M. Byllesby, S. C. Dieffie, W. P. Johnson, B. F. Muh, Jr., H. C. Levis. Incorporation papers sent to Northwest Thomson-Houston Electric Company, 403 Sibley street, St. Paul, Minn.

Port Richmond, S. I.—The Port Richmond and Prohibition Park Electric Railroad Company; capital, $50,000. Promoters, W. J. Demarest, William T. Wardwell and Joseph H. Bogardus, of New York city; B. F. Funk, C. L. Haskell and E. D. Clark, of New Brighton; Isaac K. Funk and Alexander S. Bacon, of Brooklyn.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.
ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1546 CORTLANDT." TELEPHONE CALL.

BOSTON OFFICE:
W. I BARKER, Room 29, 620 Atlantic Ave.
WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.
CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."
EUROPEAN OFFICE:
CHARLES FFRENCH, Editor for Europe.
HOTEL VICTORIA,
Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London.
Telegraphic Address: Ffrench, "Victoriola." London.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
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SUBSCRIPTION TO THE ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy. - - - - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, DEC. 19, 1891.

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It is encouraging to note the improved physical condition of Mr. Cyrus W. Field. The latest reports state that he is very likely to recover his health.

The electric heater for street cars should be adopted by street railway managers for one reason alone, if for no other—there is no danger of fire. The "deadly car stove" has begun its annual campaign by causing a fire which destroyed 35 electric cars at St. Joseph, Mo.

Storage battery litigation is rapidly approaching a final focus. The files of the ELECTRICAL REVIEW contain the whole story of this interesting fight. The Consolidated Electric Storage Company is undoubtedly the exclusive licensee of the Brush Electric Company for storage battery manufacture. The final decision of the newly formed Circuit Court of Appeals will settle the question as to where the monopoly rests. We are told that the Consolidated Company is in a position to immediately execute any order for storage batteries.

It appears from the personal recollections of Dr. Van der Weyde, appended to the biography of Jacobi, found elsewhere in this issue, that the primary battery swindle was known 40 years ago. After it become known that Jacobi had propelled on the River Neva, at St. Petersburg, Russia, a large boat by means of an electric motor operated by a galvanic battery, scores of inventors, each possessing a peculiar kind of motor and a peculiar kind of galvanic battery, were exhibiting their combinations, with the same purpose in view as the primary battery schemers referred to above. All of them attempted to obtain cash for stock or cash for some patent rights they had secured from some great inventor, and after putting it in operation they found it desirable to sell it again to somebody else.

At the head of these stood a certain Paine, who always gave his exhibitions in various cities next door to some machine shop having steam power, with which he made some secret connections, so as to be able to show the virtues of his patent electric motor, which would drive a circular saw by means of a small battery, of which the cost was claimed to be merely nominal.

ELECTRIC LIGHTS AND THE GOVERNMENT OFFICERS.

The electric lighting fraternity continues to be a source of worriment to the Government Light-House Board. The great number of private lights on bridges and along the shores of navigable waters, which is rapidly increasing, makes it exceedingly difficult and dangerous for navigators to sail by the official lights maintained by the government, and they are constantly clamoring for relief. The law gives the Board authority to regulate the placing of lights on bridges, etc., but, as it imposes no penalty on persons who disregard the orders of the Board, the government is powerless in the matter. The recommendation of last year that the law be amended will be renewed. The light-house officials have given up the idea of using electric lights in light-houses. The electric light which was established for the purpose of testing its adaptability to the service proved so unsatisfactory to navigators and brought such earnest protests from shippers that it was abandoned. The complaint against it was that it was too bright and dazzling. A pilot sailing a vessel across the electric lighted area could see nothing when he got beyond it, and vessels were obliged to have two pilots, one to face the brilliancy of the carbon arc, the other to peer through the gloom of the lard oil lamps.

Commander C. H. West, the light-house inspector of the New York district, reports, in relation to the Gedneys Channel electric lighted buoys, that the operation of the plant on shore has generally been good, but that much trouble has been experienced from injury to cables and breaking of lamps. The following interesting items are taken from his report:

The past winter of 1890–'91 was very severe in its treatment of the buoys, lamps and their cable connections, as the weather was more tempestuous than during the two previous winters of 1888–'89 and 1889–'90.

Owing to the unusually heavy seas on Gedneys Bar, many of the incandescent lamps had but short life, and it was an incident of every two or three days during the stormy months of December, January and February, to send a tender from the depot to Sandy Hook for the purpose of renewing the electric lamps or remedying slight defects of the general plant.

Another reason for a short life of the lamps during the winter was the fact that the output of lamps by the Edison Company during the early winter was inferior in quality to their customary standard. This complaint of bad quality was not confined to this office, but extended to commercial circles as well.

During the winter the defects of the lamps were carefully watched by this office, and the Edison Company endeavored to eliminate their errors one by one as they exposed themselves.

In this progression the insulation of the wires was finally carried quite through the plaster of paris at base of lamp, thus preventing short circuiting when the plaster dampened on exposure of sea water.

Improvements were also made in the junction of the platinum wire with the carbon. The current was increased to about four amperes, giving greater brilliancy with the same life.

The larger spiral filament has been retained, but inclosed in a five inch bulb in place of the smaller oblong bulb formerly in use.

The five inch globe is found to heat very much less than the oblong pattern, and thus not be so liable to crack when coming in contact with cold sea water during winter.

The most trying situation for the lanterns and the incandescent lamps within is found to be a strong tide in one direction pressing the buoy down while a heavy sea runs contrary to the tide. The sea thus breaks over the head of the buoy and fills the lantern with salt water, which, if cold, is apt to crack the incandescent bulb heated by the filament. This is best exemplified in winter, when the sea of an easterly gale is running contrary to a spring ebb tide.

Commander West further reports that there have been frequent interruptions in sections of the cables connecting the dynamos with the buoys, caused almost entirely by the anchors of vessels which pick up the cables and exert such a strain upon them that the cables either break or fly back in kinks after the strain subsides. The masters of schooners pay very little attention to the notices to mariners, and do not hesitate to anchor at the cable crossings, even when they are familiar with their location. It is not uncommon for pilot boats to anchor on the cables with the risk of extinguishing the the lights, notwithstanding the fact that the pilots whom they take outside the harbor may be delayed in bringing transatlantic liners through the channel for want of the lights.

The monthly report of vessels passing the bar at night records, as coming in, the largest steamers plying to the port of New York, such as the "Etruria," "City of Paris," "Majestic," "Fürst Bismarck," "Umbria," "La Champagne," "Lahn," "La Bourgogne," "Germanic," "Ems," "Augusta Victoria," "Teutonic," etc. In November, 1890, 101 vessels passed the bar, 67 coming in and 34 going out.

The commander adds:

Not long ago an ocean-going steamship, in leaving her dock at Jersey City, plowed up the soft bottom with her powerful propeller, and secured a costly and valuable catch in the shape of about a dozen submarine cables, which enmeshed themselves in the blades of the propellor so effectively that all the cables were torn asunder and the ship had to go into dry dock to clear her screw of the garlands of iron, hemp and kerite, with which it had become embellished—not to say embarrassed. The learned judge who presided over the argument as to whether the telegraph company, which owned the cables, or the steamship company, which owned the inquisitive vessel, was the aggrieved party, decided in favor of the latter, holding that a harbor is to be kept free for navigation, and that a steamer is entitled to plow through mud as well as water, cables or no cables. If the cables were thought to be secure because they lodged in two feet of silt, why so much the worse for the cables, or rather, for their owners. According to the learned judge, ocean steamers possess the right of way through the silt, even down to hard rock, and the waters of a harbor for purposes of navigation have no "bottom." This is cold comfort for owners of submarine cables in harbors, but by way of adding insult to injury, the very practical suggestion was made that cables might be laid in a species of submarine trench, and thus be kept out of harm's way when ocean steamers (or others) find it necessary to "take the ground."

An improved condition in financial circles is apparent.

This mild Winter we have enjoyed thus far in the East is conducive to much electric railway construction.

That portion of Mr. Bishop's article on the reflecting galvanometer which appears in this issue contains a number of useful and practical "kinks."

The vitrified clay tile conduit seems to have come to stay. A number of telephone companies are laying it down and using it with considerable success. Cincinnati, Pittsburgh and Milwaukee are already equipped with several miles of tile conduits.

A New York man has been granted a patent for making hash. The process is described as a method of preparing hash consisting in dessicating and comminuting potatoes, then mixing them in a raw state with chopped meat, also raw, and then baking the mixture until thoroughly cooked. There is nothing electrical in this, but it is a deserving innovation which will be hailed as a boon by countless boarders. Raw meat being required by the process, they will not be pained by the recognition, under a thin disguise, of yesterday's steaks.

CORRESPONDENCE.

OUR CHICAGO LETTER.

The Chicago City Railway Company will put 250 additional cars into service on the West Side street car system and 500 new men will be employed within a week.

Incorporated.—Mexican Chemical Electric Company, Chicago; capital stock, $2,000,000; to manufacture batteries and electric goods; incorporators, W. S. Baker, B. H. Ottinger, J. C. Ottinger.

The South Park Commissioners have discussed lighting the parks and boulevards under their control with electricity. The cost and merits of various systems of electric lighting and the manner in which the lights should be distributed are the main points considered. The board expects to construct a plant of its own with a capacity of from 200 to 300 arc lights.

There have been a great many switches placed upon the market during the past year, but for quality and satisfactory results in everyday use, the Bryant switch has not been surpassed. The Central Electric Company, who are the General Western Agents for this switch, have no reason to be afraid of a waning popularity, as some recent handsome orders attest.

Personal.—J. H. McGraw, of the *Street Railway Journal*, New York, has been in the city for the last week looking after his interests in the West. Mr. McGraw will leave for the East first of next week. Payson K. Andrews, Western sales agent of the J. G. Brill Car Company, has just returned from a very successful business trip West. Mr. Andrews closed a $40,000 contract for combination cars and trucks with the Denver Tramway Company, Denver, Colo.

Chicago, December 12. M. J. B.

OUR ALBANY LETTER.

At a special meeting of the directors of the Poughkeepsie Electric Light and Power Company, Poughkeepsie, N. Y., held December 4, a resolution of deep sorrow at the death of the Hon. E. T. Turner, of Waterbury, Conn., was adopted. Mr. Turner was one of the most enterprising of Waterbury's citizens. He was a self-made man, having risen by his own efforts from a clerkship to the head of the leading dry goods store in Connecticut. In 1884 he was State Senator. He was largely interested in electric light companies and was a director of the Poughkeepsie Company. President James H. Ward, of the company, attended his funeral.

Albany is not to have the Law system of telephony after all. The committee sent to Philadelphia to look up and report their findings did not discover enough in the new system to warrant such a radical change from methods now in use here. The committee, which was sent by the Hudson River Telephone Company, consisted of Mayor Manning, General Manager A. B. Uline and Electrician Wm. H. Cull. They examined the Law system in all detail, afterwards reporting to the executive committee in New York. However, a great improvement is contemplated in the local telephone service. The company's fine switchboard was destroyed by fire last Winter. Since that time they have been using the improved Standard switchboard. The improved multiple board now in course of construction by the Western Electric Company, of New York, is said to eliminate every objectionable feature that has heretofore existed in the board of this make. When the time comes the Hudson River Telephone Company will put this board in for local use. This will greatly improve the service.

Albany, December 12. L. M. W.

NEW ENGLAND NOTES.

The Essex Electric Street Railway Company, Salem, Mass., reorganized on the evening of December 1, and elected directors.

Manager L. C. Whitney, of the New Britain, Conn., Electric Light Company, reports having put in a power circuit and added a 50 horse-power generator (Thomson-Houston) to the station equipment. Mr. Whitney has already installed several Eddy motors in connection with his company's power circuit.

The Meriden, Conn., Electric Light Company contemplate introducing electric power quite extensively in the city named. The lighting capacity of the station is as follows. 133 arcs (street lights) "American" system, 80 divided arcs (commercial) "American" system; 1,250 incandescents, 16 candle-power, Thomson-Houston system.

The Hartford, Conn., Electric Light Company is one of the most successful electric illuminating enterprises in Southern New England. Superintendent Geo. D. Johnson stated recently that several dynamos are driven by power derived from the water power station, 11 miles distant, owned by the Farmington River Power Company. The company has in operation 450 arcs and 1,350 incandescents, both of Thomson-Houston system.

The Billings & Spencer Company, Hartford, Conn., has finished several new additions to its factory. The new forging shop is one of the largest and most complete of its kind in this country. A new engine ("Ide") of 40 horse-power and a battery of H. B. Beach & Sons' tubular boilers have been added to the power equipment.

The Union Electric Manufacturing Company, Bridgeport, Conn., reports active business and a steadily increasing demand for its electrical specialties. The well known double pole switch manufactured by this company needs no special recommendation, except that it has given thorough satisfaction wherever used.

The Bridgeport Electric Light Company has made another increase in its lighting capacity consisting of the following equipment: Two Thomson-Houston incandescent machines (continuous current) of 240 amperes each, aggregating 800 sixteen candle-power lights; Armington & Sims high speed (100 horse-power) engine and a 200 horse-power boiler of the Babcock & Wilcox make.

Mr. J. F. Whitney, of Hartford, Conn., has been selected by the Germania Electric Manufacturing Company as its Connecticut agent, with headquarters at No. 280 Asylum street. Mr. Whitney has been for some time associated with Mr. James Ahern in the electrical construction business. The firm has successfully installed several isolated electric light and power plants in Hartford and elsewhere in Connecticut.

The Electric Heat Alarm Company has been organized in Bangor with a capital stock of $25,000 and these officers: President, E. M. Hersey; treasurer and general manager, E. S. Palmer. The company will manufacture a device which, attached to machinery, gives prompt notice of the overheating of any bearing. It can also be used to indicate, by electric annunciator, extremely high temperature in rooms. General Manager Palmer will have his headquarters in Boston.

The New England Engineering Company, Waterbury, Conn., has just completed the installation of an electric railway system for the Watauga Lighting and Power Company, at Johnson City, Tenn., and have just commenced work on a large electric light and power station at Stafford Springs, Conn. The company has a contract in hand for an immense electric installation at Elizabeth, N. J., which will comprise three Corliss compound condensing engines, several Thomson-Houston dynamos for arc and incandescent lighting, and a large generator for power circuit.

The Waterbury Watch Company, of Waterbury, Conn., has placed on the market its new model, quick stem winding and stem setting watch, and termed the "Series K." This watch is a new 18 size for gentlemen, has six jewels, enamel dial with sunk seconds, and is highly finished throughout. Made with nickel, coin silver and gold filled cases (plain and fancy); the nickel retails at $4, the silver $7.50, and the gold filled $10. I have been prompted to mention the "Series K" Waterbury watch as information to the thousands of young men employed in electrical factories, electric light and power stations, where it would prove unwise and expensive to risk the magnetization of a high-price watch, when a splendid timekeeper may be obtained for a few dollars.

Boston, Dec. 12, 1891. W. I. B.

American Institute Electrical Section.

An electrical section of the American Institute has recently been organized with the following officers: E. T. Birdsall, president; Dr. L. H. Laudy, vice-president; J. W. Hull, secretary. The section will meet on the second Wednesday of each month at the rooms of the Institute, 115 West Thirty-eighth street. This section will be similar to the polytechnic, photographic and other sections of the Institute.

OBITUARY.

George W. Stewart, a Southerner, and the inventor of a sea telephone, died suddenly December 9, at the Orlando House, No. 115 East Fourteenth street, New York, of heart disease. Mr. Stewart came to this city six weeks ago from Adamsville, Ga., to induce capitalists to invest money in his invention. It had been tested and proven successful.

Ex-Police Commissioner Isaac Struble, President of the Jersey City Electric Light Company, died in Jersey City, December 5, of Bright's disease. Mr. Struble was born in Ohio, in 1836. He was the head of the firm of Struble & Vedder, which was dissolved last year. He was a member of the New York Produce Exchange, the Crescent Club and other organizations. He leaves a wife and three children.

Mr. J. E. Talbot, of the Fort Wayne Electric Company, has been spending a couple of weeks in the East, and was a welcome caller at the REVIEW office.

EMINENT ELECTRICIANS.

FACTS ABOUT FAMOUS MEN WHOSE NAMES WILL ADORN THE ELECTRICITY BUILDING AT THE WORLD'S FAIR.—BY DR. P. H. VAN DER WEYDE.

V.

Ohm—George Simon (1787–1834); German physicist; commenced active life as apprentice locksmith in his father's shop, in Erlangen, in which city he also studied mathematics, and taught this branch afterward in several other places, until he distinguished himself so far that, at the age of 30, he was appointed professor in a college in Cologne. A year later he published a geometrical text-book, and then occupied himself with experiments in voltaic electricity. He established the fact that electric currents behave like water, in so far that they are subject to difference in pressure and difference in quantity in connection with the resistance they overcome. He expressed their mutual relation in a very simple algebraic formula, which is called the law of Ohm, and lies at the basis of all later progress in electric calculations. In 1833 he became director of the polytechnic school in Neurenberg, and in 1851 he received from the Royal Society in London the Copley medal. In 1869 he was appointed professor of physics in Munich. His name has been adopted as the unit of resistance electric currents are subject to, which resistance is as well in the generator of the current and called the interior resistance *r*, and in the wire carrying the current and called the exterior resistance *R*.

Morse—Samuel Finley Breese (1791–1872); American artist and inventor. Graduated at Yale college and went to England to study painting, where, in 1813, he received a gold medal for sculpture, returned to the United States and came to New York in 1822, where he with others organized an association, which became in 1826 the National Academy, of which he was president for 16 years. In 1827 his attention was drawn to electro magnetism by attending lectures of Professor Dana, and when he became possessed of one of Sturgeon's electro-magnets he conceived the idea of using its alternate attractions for conveying signals at a distance, and in 1835, he exhibited in the New York University, where he occupied an artist's studio, the practical operation of his conception, over a wire 3,000 feet long. In 1837, he filed a caveat in the Patent Office, in Washington, and asked Congress for aid to build an experimental line to Baltimore, but the stupid majority did not see the use of such a thing, so no action was taken. In despair, Morse went again to Europe in the hope of interesting foreign governments, but these were as stupid as our congressional majority had been, and the British Patent Office even flatly refused to grant him any patent at all for his ridiculous invention, they considered him as a crank with an electro-magnet in his brain. Perhaps Barlow's experiments had something to do with this; he was considered the foremost electrician of England, and having been consulted about the possibility of charging electro-magnets at a distance, he reported that at a distance of more than a mile it was impossible. It is now known that the magnet he used was coiled with very heavy wire, while the line used was of very thin wire. Henry, of Washington, proved about the same time that the magnets should be coiled with thin wire, and proved his experiment in a lecture at Albany, that then success could be secured. Morse returned crestfallen to the United States and at last he obtained from Congress, at the very end of the session, March 4, 1843, at midnight, the required $30,000 for experiments, and the next year the line was completed and Morse signals flashed between Washington and Baltimore. Morse sold his patent to an association of capitalists, which later became the Western Union Telegraph Company, and it was well for him that he had done so, as very soon rivals sprung up in the shape of infringements; it required plenty of cash capital to protect his rights, and in this regard he found the protection needed, by want of which many poor patentees have been defrauded.

When the writer, in 1849, a few months after his arrival in New York, rented a room in the New York University building he found copper wires tacked to the walls and halls around, and on inquiring of the colored janitor, he was informed that the room had been occupied by some artist, who did not flourish as such, but had gone in some other out of the way kind of business; when, later, finding out that the name of the man was Morse, he congratulated himself on his good luck and left the wires intact as a sacred relic for the three years he occupied that room.

Few men have had greater honors heaped upon them than Samuel Morse. Decorations and medals were heaped upon him by foreign governments, such as the Sultan of Turkey, Czar of Russia, Emperor of Austria, Kings of Prussia, Italy, Denmark, Portugal, etc., etc.; while, finally, a rare honor was conferred upon him by the erection of a bronze statue in Central Park, in 1872, an honor rarely granted during the life of a meritorious man.

Gauss—Karl Friedrich (1777–1855); a German mathematician and astronomer, who, for his merits in these services, received in 1810, from the French Institute, the great gold medal. He was from 1807 till his death professor of mathematics and director of the astronomical observatory in Göttingen. After Weber came to assist him in his labors he employed most of his time with the investigation of magnetism, invented the magneto meter, and so made most valuable observations, which were published in not less than six volumes (1837–43). His most important works were written in Latin and translated by others in English, German and French. Among them is an atlas of terrestrial magnetism. LaPlace pronounced him the greatest mathematician of Europe, and the application of this deep knowledge to magnetism and electricity has marked an era in the history of science.

Jacobi—Moritz Hermann (1801–1874); German physicist, went in 1823 to Russia and soon became eminent for his achievements in electric contrivances. In 1830 he established a short telegraph line in St. Petersburg, and in 1832 one of 18 miles long between two of the imperial palaces, and was then the first to discover that the earth could be used for the return circuit. In 1837 he invented the process of electrotyping, and in 1840 published a book under the title of "The Galvanoplastic," and was elected a member of the St. Petersburg Academy. He proposed to the emperor to organize a galvanic regiment of sappers and miners, to be trained in the management of electricity for warlike purposes. Of this regiment he was appointed colonel. He had three large batteries constructed and experimented with them to operate electric motors so as to propel ships. This he put in practical operation on the river Neva, and the publication of his results created an enormous stimulus among electricians for constructing various electro motors. The writer remembers very vividly, how between the years 1842 and 1848, there was a kind of electric motor craze all over Europe, to which he himself was also a subject, but was cured in 1848; when in 1849 he came to the United States he found this craze also prevailing furiously, with this difference, however, that here many people very ignorant about electricity wasted their time in vain attempts in this direction, of which he had a rare opportunity to become acquainted while he was engaged by the late philanthropist, Peter Cooper, to examine into the merits of scores of motors and models of motors, some made in imitation of Jacobi's devices and some in different style, all asking to be supplied with funds to build them on a large scale. The writer's advice to all was that as long as we have no cheaper electricity than that which Jacobi employed it is no use to make motors. Where the cheap electricity was to come from was then still a problem. Now we have it and improved motors also.

PERSONAL.

Mr. J. F. Morrison, of Baltimore, was a New York visitor last week.

President E. M. Barton, of the Western Electric Company, made a brief visit to New York recently.

Mr. L. S. Dumoulin, of the West End Street Railway Company, Boston, visited New York last week.

Mr. Geo. T. Manson, of the International Okonite Company, New York, last week started on a long Western trip.

Capt. F. H. Sparling, of the John A. Roebling's Sons Company, is making a profitable trip through New York State.

Mr. Morris W. Mead, superintendent of the Bureau of Electricity, Pittsburgh, Pa., a capable and wide-awake electrician, spent several days in New York recently, investigating electrical matters in the metropolis.

Mr. W. J. Denver, assistant general manager of the New England Telephone and Telegraph Company, has given up the duties connected with the superintendency of the Boston division. Mr. George Albree, who has been with the Bell Company, takes the latter position, and Mr. Denver will continue to serve as assistant to Mr. Keller.

Mr. Geo. A. McKinlock and his wife returned last week on the "Teutonic" from a year's sojourn in Europe. Mr. and Mrs. McKinlock both greatly enjoyed their visit abroad, returning in the best of health, accompanied by an infant daughter born in Paris a few months ago. After spending several days with friends in New York, they returned to Chicago, where Mr. McKinlock will resume his interests in the Central Electric Company, of that city.

Telephonic News

*** North Baltimore, O., wants a telephone exchange.

*** The American Bell Telephone Company has declared a quarterly dividend of $3 per share, payable January 15.

*** The Bell Telephone has increased rates to old subscribers at Le Roy, N.Y., from $36 to $48 per annum. New subscribers must pay $60 per annum.

*** Mr. E. D. Brink, of Ashland, has taken the position of manager of the Columbus, Neb., Telephone Exchange. The former manager, Mr. Nichols, will go to Deadwood, S. D., where he will take a similar position with the Black Hills Telephone Company.

*** The rumor which has been current at Birmingham, Conn., that the telephone company proposed moving its central office, is denied by Assistant Manager Gray. He says the Southern New England Telephone Company have no idea at present of changing their office. They have been making repairs and fixing up the present office and will not make any change before Spring. The long distance company has run its wires into the central office and is now putting in a larger switchboard to accommodate the wires.

*** After two years spent in taking testimony, the case for the United States against the Bell Telephone Company to annul the Bell patent is believed to be complete and no more evidence will be taken for the government, although the Circuit Court has extended the time until December 24. Only six witnesses were brought before Commissioner Hallet, at Boston, including Professors Dolbear, Pickering and Cross. No evidence has been taken by the government, except what had before been taken in the Drawbaugh suit. No evidence tending to prove fraud has been produced. It is evident that all the government hopes to do is to bring before the Supreme Court the Drawbaugh case once more with the expectation that the court, which was almost evenly divided on the Drawbaugh suit, may give a different decision this time.

*** It is reported that an interesting telephoning experiment was made in Melbourne during October, when the postmasters-general of Victoria and South Australia, with their principal executive officers, succeeded in establishing conversation between Melbourne and Adelaide, a distance of 500 miles. The governments of the two colonies have just completed the suspension of a No. 12 copper wire, which is to be used for the new quadruplex telegraphic instrument, and the idea suggested itself of seeing what could be done with the telephone over the wire. For over an hour an animated conversation was carried on, and the chimes of the Adelaide post office clock were distinctly heard in Melbourne, and *vice versa*. The instruments used at Melbourne were the the Hunning, Berthon, Berliner and the Blake, and the two former are said to have been found the most effective.

Alabama Polytechnic Institute.

This institute, located at Auburn, Ala., has laid down a very complete course in electrical engineering. Such colleges are a boon to the South.

Lecture by Dr. S. S. Wheeler.

Dr. S. S. Wheeler, electrical expert for the New York Board of Electrical Control, delivered a lecture before the Young Men's Institute, 222 Bowery, Tuesday evening, December 15. The subject was "Practical Applications of Electricity," and the lecture proved very interesting to the large audience present.

A New Cord Adjuster.

All construction companies and users of the numerous devices now made for adjusting electric lights suspended by flexible cord, such as hooks, balls, pea-nuts, etc., will appreciate the little invention just brought out by the McCreary Electrical Specialty Company and shown in the accompanying illustration. They have named it the "Q. and S." cord adjuster (quick and sure). Its advantages are that it can be attached to any cord *after* the lamps are hung and connected, and there is no wear on the cord by taking it up and letting it out, as is the case with some adjusters. They are

FIG. 1.—"Q. & S." CORD ADJUSTER.

made of the best insulated fibre, and are strong and durable. Costing but a trifle more than the devices now used, the difference is more than made up in the saving of labor. The "Q and S." cannot fail to become a popular adjusting device. Being very small and neat, the devices are ornamental, and they do not take up any of the cord when not in use.

A Four-Year Course in Electrical Engineering at Columbia College.

An undergraduate course of four years in electrical engineering has been established in the School of Mines, Columbia College, in addition to the present two-year post-graduate course, which has been in successful operation for several years. Thus, there will be two complete courses in electrical engineering in New York city.

The latter course is for graduates of scientific schools and colleges, and is entirely devoted to electrical engineering proper, the students having already passed the necessary preparatory studies in mathematics, physics, chemistry, mechanics, drawing, etc. This course is found to give the most excellent results by reason of the maturer years and better training of post-graduate students.

In addition to such graduate students there are, of course, a much greater number of younger men who desire to enter a course of electrical engineering immediately on leaving school, without going through a previous collegiate course.

A new four-year course has, therefore, been established parallel to the well-known courses in mining engineering, civil engineering, chemistry, architecture, etc., at the School of Mines, with the same requirements for admission, which are equal to the regular entrance examinations at first class scientific schools.

The first two years of the new course will cover the preparatory work in mathematics, physics, chemistry, mechanics, drawing, etc., required for admission to the post-graduate course. The last two years will be devoted to a thorough course in electrical engineering proper and will be equivalent to the present post-graduate course, hence there will be no lowering of standard.

As a preparation for the study of electrical engineering, the first two years of this course are equivalent to four years in any course other than electrical engineering, thereby saving much time without sacrificing any electrical engineering subjects.

The instruction in electrical engineering will be conducted, as heretofore, by Prof. Crocker and Dr. Pupin. The other subjects involved will be taught by the respective professors in those branches.

The degree given to those who satisfactorily complete the course will be that of Electrical Engineer. The new course will regularly begin in October, 1892. Examinations for entrance are held in June and September. The one-year partial or special course will be abolished next year to make room for the students in the regular courses.

THE SIXTH ELECTROCUTION.

LOPPY, A WIFE MURDERER, DIES BY ELECTRICITY.

A few minutes after noon on December 7, Loppy, a brutal wife murderer, was electrocuted at Sing Sing prison. As reported in the daily press, the witnesses, nearly all medical men, began arriving in Sing Sing early in the morning. The 7.30 train from New York brought a number. The train from Albany, which arrived about the same time, brought more. Dr. Carlos McDonald, Deputy Coroner Jenkins, Dr. Brill, Dr. Holliston, of Bellevue, and Dr. Van Gieson, arrived together shortly after 9 o'clock. They went direct to the prison under guidance of Warden Brown. There were then in the prison, besides these five, Prof. Louis A. Laudy, of this city; Dr. Samuel Ward, of Albany; E. A. Brown, State prison purchasing agent; Sidney G. Law, chaplain of the Tombs; Silas W. Edgarton, the chaplain of the prison; E. F. Davis, of New York, Dr. Spencer, of Watertown, Dr. Beekman, of New York, Dr. Evans, of Schuyler, Dr. W. E. Douglass, of Middletown, Dr. J. B. Ramson, of Dannemora prison; Dr. Hiram Barlow, of Sing Sing, M. G. Ellison, and Drs. Kingston and Ely, of Newburgh.

About 11.45 Warden Brown, Principal Keeper Connaughton and three assistants fixed the straps that were to bind the condemned man's body, and then they went to the cell where Loppy sat on his couch listening to the pleadings of Chaplain Law.

Loppy had spent the greater part of the night pacing up and down his cell. He had eaten nothing since 3 o'clock on Sunday. He had refused even a drink of coffee for his breakfast. He was a wreck. His fortitude had gone. He had said only on Sunday morning that he would welcome death as a relief, but when death approached his courage failed. The Warden's first visit had been early in the morning. He had simply gone to Loppy's cell door and said:

"Loppy, it will be to-day."

FIG. 2.—"Q. & S." CORD ADJUSTER.

Chaplain Law had stepped into the cell at the same moment, and had been with the man up to the moment the final summons came. The Warden, on his second visit, read the death warrant. Loppy was silent, but apparently did not hear. The three guards stepped into the cell.

"Come, Loppy," said the Warden.

Loppy looked up and then arose. A guard walked on either side and one behind, Chaplain Law in front, and just a step ahead of him the Warden. For a little way it seemed the large doses of stimulants that had been forced on the murderer would bear him up, but in the short walk past the screened cells of the men who are soon to follow him his knees shook and the guards were forced to hold him up. It was just three minutes before the noon whistle blew that the procession reached the execution room. As the men entered, the witnesses uncovered their heads. Loppy's one eye ran over the faces of the crowd and then it rested on the chair just an instant. An involuntary groan broke from his lips. Some of the men who had gathered there to see him die turned their heads toward the wall.

Dr. McDonald, Dr. Jenkins, Dr. Ward, Professor Laudy and Warden Brown stepped quickly to the chair. Loppy followed them and turned and sat down. In a moment he seemed to shrink to half his size. His head bent forward on his breast. A shiver went through his body. The guards lifted him up and pulled him back straight in the chair. They loosened their hold and down he went within himself again. Again they pulled him up, and this time held him until the stout straps were drawn across his chest and then about his arms and wrists and legs. There were 11 straps to buckle all told. The doctors directed the work. As it was being done Loppy muttered and drooled. One electrode was to be fastened on the calf of the right leg, and to accommodate it the trousers leg was rolled up. It took three minutes to do all this. Some of the witnesses turned pale and wished they were well away.

Beside the chair there was a pail of water in which a large quantity of salt had been dissolved. One of the doctors took the sponges from the electrodes and soaked them in water. The big electrode was fastened quickly, and then the doctor took the metal cap and placed it over the man's head and buckled the strap under the chin. Warden Brown caught the wire that dangled from the long arm that reached from the top of the box where the executioner was stationed. He passed it through the electrode on the head and fastened its bare end with a thumb-screw.

The Warden, Dr. McDonald and Professor Laudy slipped to the switchboard. The Warden signaled for the turning of the current into the board. The big whistle blew just then and all the machinery in the prison buildings stopped, while the whirring of the dynamo could be heard faintly as the power was turned into it. The 16 lamps over the switchboard lighted up. The voltmeter, when the Warden signaled for full power, registered 1,750 volts. Drs. Ward, Van Gieson, Ransom and Jenkins, watched it, while Dr. McDonald and Professor Laudy stepped to the chair. The Warden held his hand on the switch that would turn the current into the inner switch which was operated by the executioner. Dr. McDonald and Dr. Ward took out their watches. The other witnesses held their breaths. Principal Keeper Connaughton stood by the chair. He leaned over and said:

"Good-by, Loppy."

Dr. McDonald glanced over the chair for the last time to see that everything was in order. Then he turned his head toward the Warden. "Good-by, Loppy," again, said the principal keeper. Before the words had left his lips Dr. McDonald nodded, the switch was turned by the executioner and the current leaped into Loppy's body. The body seemed about to burst from its bonds. The straps that held it strained at their fastenings, and the chair itself cracked. The hands clinched so tightly that the nails cut deep into the palms. The muscles of the right leg contracted and drew up as far as the straps would permit. The chest was thrown forward, the head back, and every vein in the face seemed about to burst. The whole body twisted and seemed about to be torn apart. The sight made the lay witnesses sick and they turned away. The 1,750 volts shot through the body for 15 seconds, and then Dr. McDonald nodded and the switch was turned off. Loppy was not dead, the laymen say. The current had been off five seconds when there came convulsive gasps and labored breathing. The doctors said the windpipe, which had been closed by the shock was opening. The lips moved as though in an effort to speak. The body, made rigid by the current, was now relaxed and limp. The coolest man in the room was Dr. McDonald. He paid no attention to the signs of life. Leaning down he filled a rubber syringe with the salt water and squirted it first on the sponge in the head electrode and then on the sponge in the other. One minute had passed since the current was turned off. The voltmeter still registered 1,750 volts. Dr. McDonald glanced at his watch and nodded again at the Warden. In a moment the electricity was coursing through the condemned man's body again. There were the same convulsions as before and the apparent effort to break the bonds that held the body. The eyes were open and staring and seemed starting from his head. At the end of 12 seconds the eyeball of the left eye seemed about to burst. Some of the witnesses said it did break. At the same time the hair and flesh at the points where the electrodes were ap-

plied were apparently burning. A little smoke arose from each electrode, and some of the witnesses say that the odor of burned flesh permeated the room. At the end of 14 seconds Dr. McDonald again nodded to the Warden and the current was turned off.

But Loppy was not yet dead, the laymen say. One of the doctors felt a flutter of the pulse in one wrist, while another detected a flutter of the heart. But Loppy was dead they said. There were three distinct respirations. These the doctors said were due to reflex muscular action. Dr. McDonald again wet the electrode sponges. Sixty-six seconds elapsed between the second time the current was turned off and Dr. McDonald's signal to begin work again. This time the sponges dried quickly and the flesh and hair and the sponges themselves blistered and burned. The doctor held his watch, it seemed to the witnesses an interminable period, although it was only 20½ seconds, before he signaled for the last time to turn off the switch.

Then Loppy was dead.

Warden Brown, after all the witnesses and the doctors had gone, made a statement for the benefit of the press. He said the execution was a complete success. The current was on when the 12 o'clock whistle blew. There were two official timekeepers. One gave the total time of the application of the current as 49½ seconds. The other made it 50⅛ seconds. Death was instantaneous. Beyond a sudden stiffening, there was no movement of the body. When the current was stopped the body collapsed. There were no marks of burning or disfigurement of any kind. Loppy was pronounced dead at 12.05 o'clock. Then the Warden said he telegraphed directly to Gov. Hill the result. He also said that the execution would have taken place at 10.30 o'clock, but that some of the visiting doctors asked that an experiment be tried with the apparatus. He would not tell what was killed. About the autopsy the Warden said that it was made immediately after Loppy was pronounced dead.

The doctor's report of the official time of the execution was as follows: First shock, 11:54:36; broken to wet sponges, 11:54:51; time, 15 seconds. Second, 11:55:05; broken to wet sponges, 11:55:16; time, 11 seconds. Third, 11:55:30½; broken, 11:55:46; time, 15½ seconds. Fourth, 11:56:06; broken, 11:56:16½; time, 10½. Total time, 52 seconds. Loppy was declared dead by all the doctors at 12.05 o'clock.

Press Comments on the Latest Electrocution.

It is difficult to overcome the sense of horror that attends death by the electrical current.—*Cleveland Plaindealer.*

One of the first things the State of New York should do is to repeal its electrical execution law.—*New Haven Evening Register.*

The execution of the murderer Loppy in the Sing Sing prison at noon yesterday was a quiet, orderly, decent performance of the law. This latest demonstration of the efficiency of the new method of inflicting the death penalty will probably be accepted by the people and by the legislature about to assemble, as a satisfactory vindication of the main intent of the statute. The evidence of its adequacy and mercifulness has been accumulating for more than a year, and is now strong. There is no reason to believe that the subject of the process remains conscious for more than an inappreciable fraction of a second after the current has been applied.—*New York Tribune.*

Martin D. Loppy, when received at Sing Sing, was described as "a physical wreck, deaf, blind in one eye and with his whole system shattered by drink." The wreck was made total by electrocution yesterday. The process is thus described: "The body of Loppy stiffened with a suddenness that was startling to the witnesses; it strained against the straps till they seemed cutting into the flesh; hot salt water dripped down on the face and hands of the body, scalding them in places; where the electrodes were bound the heat had burned the skin, and it was puffed and blistered." It was even worse than this. One of the tortured victim's eyes burst in his awful agony. And yet one man said that "there was no suffering"; but it was the prison chaplain who said it, not the victim. Incidentally it may be remarked that this stiffening, strap-cutting, boiling and blistering scene occurred in the civilized State of New York, near the close of the nineteenth century of the Christian era.—*New York Morning Advertiser.*

Mr. Henry C. Davis, ex-president of the New York Electric Club, is detained at home by a slight indisposition.

Fig. 1.—Dawes Electric Light Support.

Fig. 2.—Dawes Wall Bracket Support.

Fig. 3.—The Hollings Electric Bracket Back.

Dawes Electric Light Support.

R. Hollings & Company, 547 Washington street, Boston, are the sole makers of the Dawes electric light support illustrated herewith. It is designed for use in machine shops, mills and manufactories where an adjustable electric light is needed. The support shown in Fig. 1 is designed for a ceiling light, is adjustable in length and swivels at the ceiling. The wall bracket support, Fig. 2, has a range of adjustment from 20 to 36 inches and the lamp is adjustable at the end of the support.

The Hollings electric bracket is a very neat and serviceable device and is illustrated in Fig. 3.

Behring Strait Telegraph Scheme.

To the Editor of Electrical Review:

Your correspondent, "H. L.," writing from Seattle, Wash., is not "adjusted" to all the facts concerning the abortive attempt to establish telegraphic communications with Europe, *via* Behring Strait, in 1864, '65 and '66. He credits myself with being at the head of the expedition. This is not history, and I feel it would be unjust to others to allow it to pass uncorrected. Col. Chas. S. Bulkley (well known in war history as the Superintendent of Military Telegraphs in the South) was the commander-in-chief of the enterprise, having both the land forces and the fleet under his charge. It is true that the flagship was the "Geo. S. Wright," and that the officers and operators were gaily uniformed. Your correspondent mixed up two different expeditions, evidently. Your humble servant had charge of the work through Oregon and Washington Territory, terminating at New Westminster, on the Frazer River, which was the initial point of Col. Bulkley's work. My flagship was the little stern wheel steamer "Union," serving as camp and "convoy" to two "wherries" and a "duplexed" canoe. Our uniform! Yes, it was a *pretty uniform*, and the force could readily have passed for the children of "Sam Patch," or, if individualized, for

"The man all tattered and torn,"

of the nursery rhyme. Nine months of rustling with the briars and brush of that "forest primeval" "where rolls the Oregon," played sad havoc with our apparel and all the protuberances and angles of our anatomy, so we were *uniformly* ragged.

One more item. The poles sawed at Seabeck for the Russian line were not all burned, as stated. Enough were shipped to Southern California, in 1870, to build a line from San Diego to Santa Barbara.

I will thank you to print this that no injustice may be done Col. Bulkley.

Respectfully, R. R. Haines.

Los Angeles, Cal., Dec. 1, 1891.

TELEGRAPHIC

.... Telegraph operators on the Southern Pacific road in Arizona and New Mexico have struck.

.... A duplicate cable, between Trinidad and Demerara, has been laid for the West India and Panama Telegraph Company.

.... Western Union officials admit that a postal telegraph scheme will certainly be presented to Congress, but they say that it will not be reached at this session and will be practically shelved.

.... The military telegraph line from Rawlins to Lander and Fort Washakie, Wyoming, has been abandoned. Lander people will try to lease the line to that city from the government and operate it.

.... The Commercial Union Telegraph Company will build, it is said, a line from Whitehall, N. Y., to Montreal, on the west side of the lake. The company now reaches Plattsburgh by cable across the lake from Milton.

.... The building of the French Telegraph Cable Company, at North Eastham, Mass., was sold at auction last week. It is reported that E. F. Reed, the agent of the Cape Cod Land Company, is the purchaser and will use it for a hotel.

.... The Postal Cable Telegraph Company has completed its line from Savannah, Ga., to Charleston, S. C., direct by the country roads, instead of following the railroad. To do this it was necessary to lay a cable across the Savannah river opposite the city.

.... The Western Union Company declares a one and a quarter per cent. dividend payable January 15. Books close December 21 and reopen January 2. The actual net return for September 30 quarter was $2,171,154, and estimated $2,000,000, an increase of $171,154. Net for December 31 quarter is estimated at $2,000,000, same as last year.

.... Nothwithstanding the denial of the report that the American District Telegraph and Mutual District Messenger Companies, of New York city were to be consolidated, it was said, last week, by one who should know, that negotiations for such consolidations are now being carried on, and are likely to be consummated in a very little time, as soon as some small details concerning one branch of the business have been satisfactorily arranged.

Western Union.

It is said the selling of Western Union stock this week has considerable significance, because the sales have come very largely from a broker who is known to have the account of one of the Astors.

A director of the company says: "Never before in the company's history was it in as good financial condition as it is to-day. Never before has it been so economically operated. This is important in view of the fact that it has 28,000 employés. I venture to say that it the government undertook to operate the company it would not pay its fixed charges.

"It is not generally known that many years ago the whole plant and patents of the company were offered to the government for $100,000, but they were declined. A few men with capital saw what the prompt business promised and took hold of it and built up the great corporation which now exists. Now the government proposes to destroy a property thus built up by private capital by talking of building competitive lines."—*Boston News Bureau.*

The Crocker-Wheeler Motor Company, of this city, secured the following awards at the recent Augusta Exposition: Four first prize gold medals for the best electric motor, fan outfit, pumping outfit and dental outfit, and a special gold medal for the best electrical display.

* * Senator Henry Keller, of Sauk Center, Minn., is experimenting with an electric plow.

* * It is expected that within a few weeks a new electric freight locomotive will be in operation on the electric railway at Whitinsville, Mass.

* * It is expected that an electric street railway, 23 miles long, connecting Indianola with Des Moines, Ia., will be built in the near future at a cost of $250,000.

* * The Seattle, Wash., General Electric Company has just received a new 650 horse-power E. P. Allis engine. It is intended to keep in reserve in case any of the other engines break down.

* * The Interstate Consolidated Rapid Transit Railway Company is contemplating changing its elevated road to an electric line at some time in the future, and an ordinance has been introduced in the council, at Kansas City, Mo., granting it the privilege of substituting electricity as a motor power.

* * The Lawrence, Mass., Electric Railroad Company have contracted with the Newburyport Car Company for three large snow plows for service during the winter months, and it is expected that one of them will be shipped the early part of this week. They are known as the double end sheer plows, and can be run in either direction without turning. Each plow will be operated by two 15 horse-power Thomson-Houston motors.

* * Following the application for a receiver for the Keokuk, Ia., Electric Street Railway and Power Company, came the introduction last week in the city council of a resolution forfeiting the rights and privileges granted the company for failure of its contract with the city. The resolution was referred to a committee. The application for a receiver was heard in the superior court, and H. C. Reiner, at present secretary and treasurer of the company, was appointed.

* * Advices from Berlin state that the project for the construction of a high level electric railway in that city has assumed definite form. Detailed negotiations have taken place between the chief magistrate, the chief of police, the Ministerial Architectural Commission, and Messrs. Siemens and Halske, and the proposal has been accepted. According to the report, Messrs. Siemens and Halske will, now that the consent has been given, work out the project and lay it before the authorities. The line is to form a connection between the Zoological Gardens Station and the Warschauerstrass (near the Silesian Station) and the Wasserthor and Dennetwitzplatz stations.

Electric Railway Franchises in California.

The constitution of California provides that no act shall be passed extending the charter of any corporation or remitting the forfeiture of a franchise. Where during the pendency of an action forfeiting the charter of a street car company operating under a city ordinance two acts were passed, one amending the civil code of the State so as to invest municipal corporations with power to authorize street railways to use electricity as a motive power, and the other ratifying existing ordinances granting such power, the Supreme Court of California held, that the acts did not extend the company's franchise or charter, and that as there had been no decree of forfeiture there was none to remit, and, therefore, the acts were not repugnant to the constitution.—People *vs.* Los Angeles Electric Railway Company, reported in the *Railway and Corporation Law Journal.*

Plant of R. Wolf at Magdeburg-Buckau, Germany.

The machine shops and boiler works of R. Wolf, at Magdeburg-Buckau, were founded in 1862, and at present employ 950 workmen. The combined semi-portable engine and boiler built by this company connected directly with dynamo, has been in great demand throughout Germany, and they have been sent to South America, Italy, Russia, Spain and many other countries. The Emperor of China, as well as the Sultan of Zanzibar, have each plants from this firm.

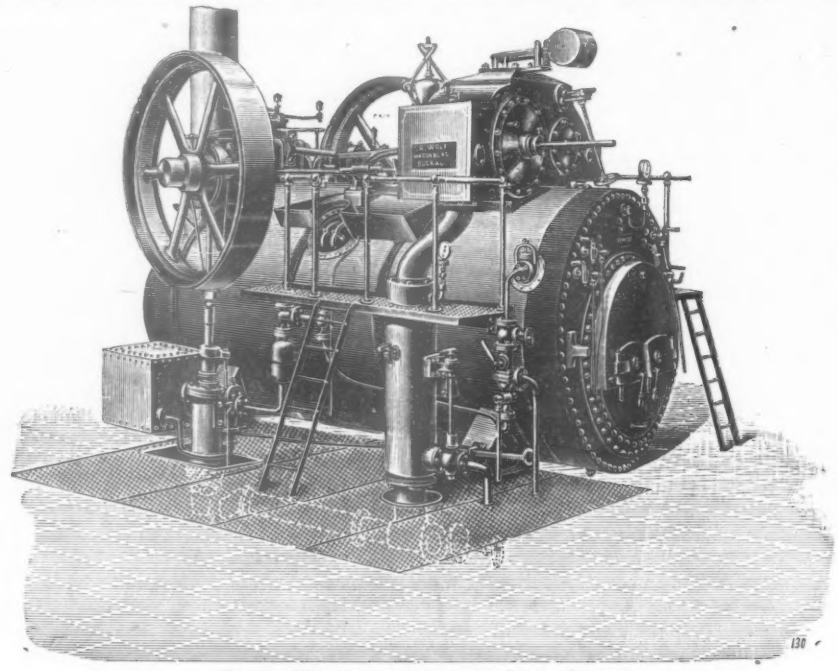


FIG. 1.—WOLF'S SEMI-PORTABLE STEAM PLANT.

The machines for the electrical plant in the Royal Palace at Berlin were furnished by this company. The plant exhibited at the Frankfort Electrical Exposition (Fig. 1) was equipped with a compound semi-portable engine of this type, with condenser.

The quiet and steady motion which was noticeable with Wolf's engines, as here exhibited, renders them particularly fitted for electric lighting plants. As in such installations the expense of fuel constitutes the chief item of working expense, purchasers are especially anxious to select an engine economical in its working. In cases where little space is at one's disposal, the semi-portable engines will be very appropriate, and cost even less than a stationary engine with separate boilers. The well-known firm of Siemens & Halske, of Berlin and Vienna, has already received a large number of these engines of various patterns.

The works of R. Wolf are large and well equipped with electrical machinery. For instance, there are at present three electric cranes, each having a six horse-power Siemens & Halske motor, and two large cranes which will soon be equipped with motors of larger capacity; making a total of five electric cranes. An electric elevator driven by a motor furnished by the Algemeine Electricitats Gesellschaft, of Berlin, as well as the electric ventilators and blowers in the blacksmith shops and foundry, are in continuous use. The electrical plant at the works is divided into two parts, one used only during the night and the other day and night. The part of the plant operated during the daytime only furnishes current for the electric motors of the elevators, cranes, ventilators and blowers, while the other gives current for 65 arc lamps and about 1,000 incandescent lamps of 16 candle-power each. The latter has two 50 horse-power compound semi-portable engines connected to four Siemens & Halske direct current dynamos, generating a current of total capacity of 60,000 watts, *i. e.*, each machine giving 15,000 watts (240 amperes at 65 volts). These machines have a normal speed of 780 revolutions per minute.

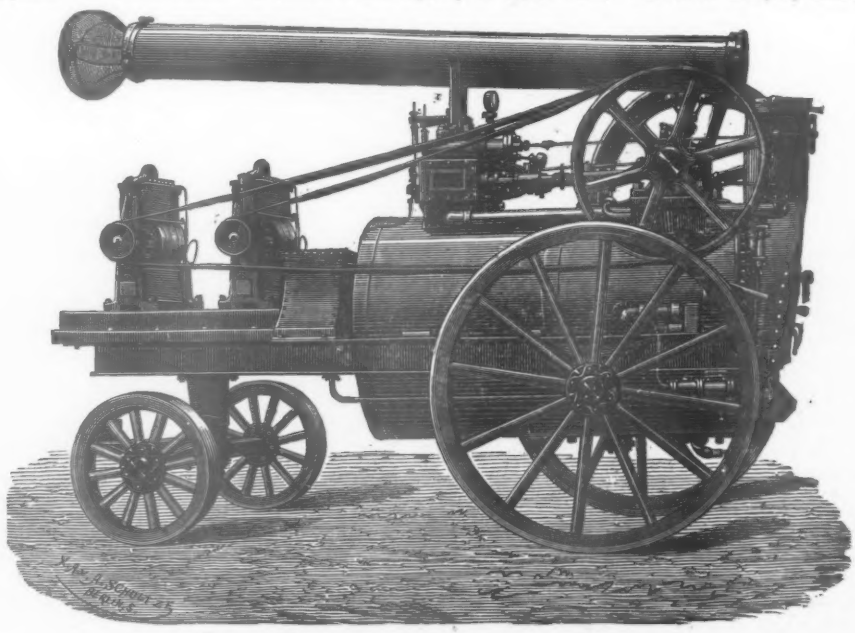


FIG. 2.—WOLF'S PORTABLE ELECTRIC LIGHT PLANT.

An accumulator plant is now being added which will enable the firm to light its offices, etc., when all of the machinery has been shut down. These accumulator cells are of the Tudor system and furnished by the Accumulatoren-fabrik Actien Gesellschaft. The accumulator plant will be charged during the day and the voltage will be changed from 66 volts to 37 volts, by means of a Siemens & Halske direct current—direct current transformer. The motor armature of the transformer receiving current, 212 amperes at 65 volts, and the dynamo armature delivering current, 287 amperes at 37 volts, the speed in both cases, of course, being the same, 950 revolutions per minute.

FRANK C. PERKINS.

Bids for City Lighting.

These bids for lighting the city in 1892 were opened by the Gas Commission, last week: Equitable Gas Company, $12 a lamp; Standard, $13.04½; Consolidated, $17.50; Mutual, $17.50; Central, $27; Northern, $28; New York and New Jersey Globe, for Woodlawn Heights, $22. The bid of the Consolidated Company was for lighting the entire island. The others were partial. The bids of the electric lighting companies were a little higher than usual. The United States Company wants 40 cents a lamp a night, for 235 lamps, and 45 cents for 66 lamps. The East River Company asks for 40 cents for 247 lamps and 60 cents for 16 lamps. The Brush Company's bid was 40 cents for 151 lamps and 45 cents for 114 lamps; the Mount Morris Company, 40 cents for 154 lamps; the Harlem Company, 40 cents for 161 lamps, 45 cents for 15 lamps, and 50 cents for 19 lamps, and the North New York Company, 45 cents for 246 lamps.

The Cedar Rapids, Ia., Electric Light Company has filed amended articles with the Secretary of State, increasing its capital stock to $150,000.

The Problem of Aerial Navigation.

In the absence of any governmental or concerted effort, *The Cosmopolitan* magazine has determined to attempt the solution of the problem of aerial navigation, and under its direction a series of experiments will be made which it is hoped will be brought to a satisfactory conclusion.

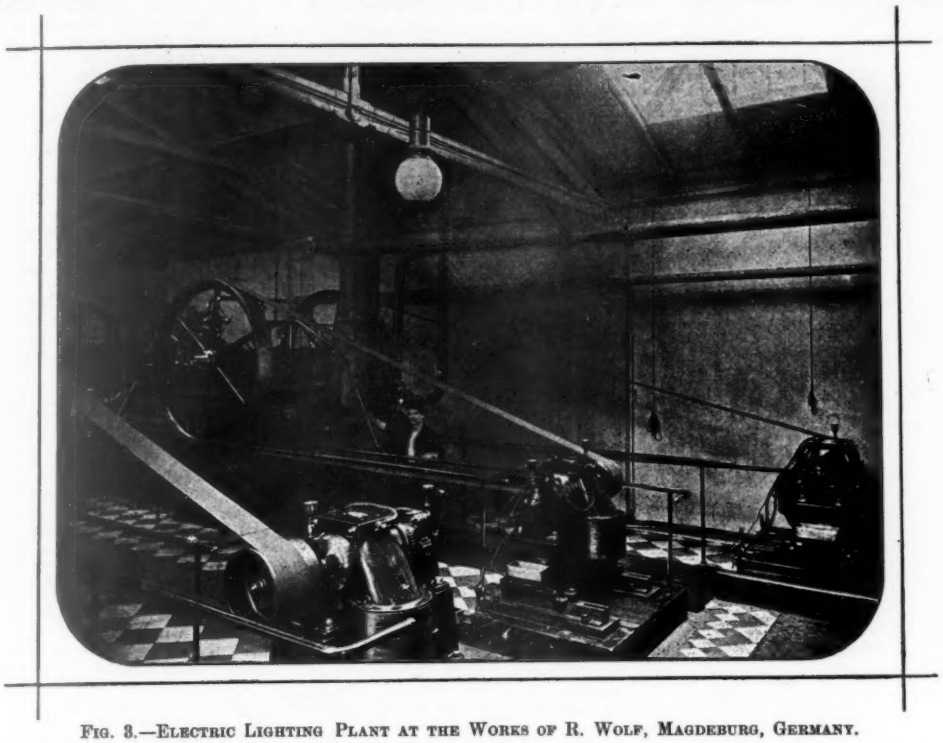


FIG. 3.—ELECTRIC LIGHTING PLANT AT THE WORKS OF R. WOLF, MAGDEBURG, GERMANY.

Unquestionably, the greatest mechanical problem unsolved is that of aerial navigation. When one considers the far reaching effect which it would have upon the civilization of the age, and the benefits which would accrue to mankind, the wonder is that the affair has not been ere this seriously studied by some of the governments of the world. *The Cosmopolitan* does not enter lightly upon the undertaking. A portion of the plans to be put into execution were submitted to the French government by a member of *The Cosmopolitan* staff as long ago as 1867. There are undoubtedly great difficulties in the way, but the attempt will be steadfastly pursued by *The Cosmopolitan* under the direction of the ablest scientists whose aid can be obtained, until success is secured, even if it has to be carried on through a series of years.

No patents will be applied for as the result of inventions made. If success crowns the work, the result will belong to the public.

Mr. Thomas A. Edison, in response to an offer by *The Cosmopolitan* of $100 per hour for services in consultation, said: "This matter is of so great interest to the public that I freely give my services without pay—and the use of my laboratory, too, if you need it for experiments." The services of Professor King, of Philadelphia, who has made more than 300 ascensions and is recognized as the most experienced living aeronaut, have been engaged as advisor in practical aeronautics. The supervision of the engineering work and mechanical construction has been entrusted to Captain Lewis M. Haupt, late of the Engineer Corps of the U. S. Army, now Professor of Engineering, University of Pennsylvania.

Plans and suggestions will gladly be welcomed from all sources, and due credit given for ideas utilized.

The Cosmopolitan offers $500 in prizes for three essays upon aerial navigation.

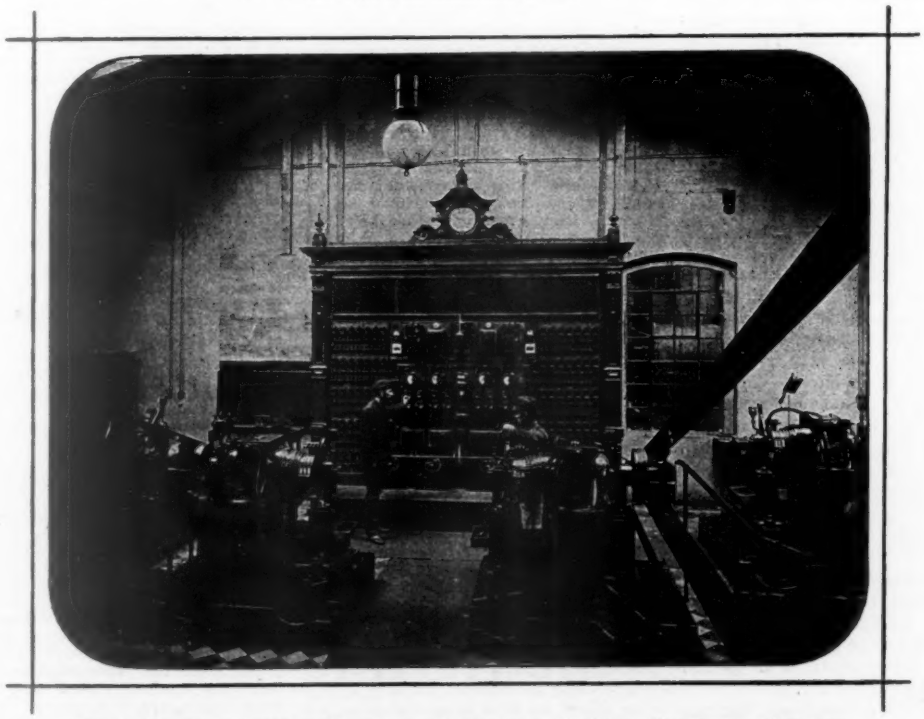


FIG. 4.—ELECTRIC LIGHTING PLANT AT THE WORKS OF R. WOLF, MAGDEBURG, GERMANY.

First, $250 for the most valuable paper suggesting the best methods of accomplishing the navigation of the air.

Second, $100 for the second most valuable essay on the same subject.

Third, $150 for the best paper on the result which successful aerial navigation would have upon the moral and material interests of the world.

The papers to be in the possession of *The Cosmopolitan* before February 1, 1892.

Wires and Poles Still Down.

Representatives of the electric lighting companies whose wires and poles tumbled into the street on First avenue, during the recent storm, applied to Commissioner Gilroy, last week, for permission to replace the poles and wires. The Commissioner, however, firmly refused to grant any permit for the erection of poles where subways have been built.

John Whalen, of No. 135 Sands street, Brooklyn; Harvey Woodman, of No. 1861 Lexington avenue; William Charles, of No. 229 East Eighth street; William McKenzie, of No. 39 East Eighty-seventh street, and Frank A. Knight, were arrested last week by the police of the East Twenty-second street station, for repairing the wires of the Manhattan Electric Light Company at First avenue and Twenty-sixth street. They were released in $500 each to appear before Judge McMahon, in the Yorkville court.

The bursting of a steam pipe in the plant of the Allentown, Pa., Electric Light Company, last week, placed the town in darkness until repairs could be made. No one was hurt by the explosion.

ELECTRIC LIGHT NEWS

—— The Utica, N. Y., Electric Light Company is installing a 1,500 horse-power Corliss engine.

—— It is reported that the Southwestern Electrical Supply Company, of Kansas City, Mo., has made an assignment.

—— It is reported that the gas company at Madison, Ind., wants to buy the city's electric light plant and consolidate the two interests.

—— The American Electric Light Company has been awarded an attachment against the Gooch Electric Light Company, of Louisville, Ky., for $680.80, on an old judgment.

—— The contract for furnishing and putting electric light plants into Cruisers Nos. 5 and 6 has been awarded by the Bath, Me., Iron Works to the Fisher Electric Company, of Detroit, Mich.

—— The Northwestern Thomson-Houston Electric Company paid its first two per cent. dividend on the preferred stock December 15. Checks were mailed from the Old Colony Trust Company, Boston.

—— The benefit of the electric light in the factories of Germany is said to have been so marked that it is proposed to make its use compulsory in all works where artificial light is employed during working hours.

—— Huntington, Long Island, is about to fall into line on the question of electric lights, a company having recently been formed to push that project. A contract for the purchase of the necessary site has already been signed.

—— The Edison General Electric Company is fast filling up the five big buildings at Schenectady, N. Y., that will be occupied by the Bergman Company, with machinery and stock. In a short time 1,000 men will be employed in the shops.

—— Word comes from Chicago that about 20 of the managers and other officials of the Edison General Electric Company from the large cities of the United States held a secret meeting at the Auditorium last week. Nothing but the regular business of the company and the methods of establishing electric plants, it is said, were discussed.

—— The Allegheny County Light Company, Pittsburgh, was awarded the contract last week for the city street lighting. The contract runs for four years, beginning on the 1st of January next. According to the calculations of Chief Bigelow and Controller Morrow, the amount will be less before the end of the first year than is paid at present, and decrease even below the present rate long before the contract has finally expired in 1896. The bidders' proposals were for arc, gasoline and incandescent lights. The Allegheny County Light Company bid $96 a year on arc lights, $17.95 on gasoline lamps and $18 for incandescent lamps.

—— Suit was entered at Philadelphia, last week, by F. C. Allen against the Brush Electric Light Company, to recover $3,000 for breach of contract and the loss of his business. Allen says he contracted with the defendants to furnish him an electric light in the rear of 1246 Chestnut street, to be used in connection with a stereopticon for advertising purposes, for one year, from December 9, 1890. He was to pay monthly, a discount of 10 per cent. to be allowed if paid before the 10th of the following month. On June 1, 1891, the company demanded the pay in advance, which was not according to agreement. When this was not complied with, they took the light out. This, he says, has ruined his business, as he has been unable to go on without the light.

OUR ST. LOUIS LETTER.

The Southern Electrical Supply Company have their hands full filling orders, especially in wire.

The Clayton and Forest Park Railway Company will, if it secures the right from the city to connect with the St. Louis and Suburban and the Lyndall Railways, build an electric line from the city limits to Clayton, Mo.

The Municipal Electric Light Company, owing to the bad weather, was somewhat crippled in its city lighting, the lamps refusing to work properly. One night 600 "outs" were reported; however, it now has things running very smoothly.

The Emerson Electric Company were forced by the rapid increase of their business to move to larger quarters. They are now located at 1108–1110 St. Charles street. They have a very steady demand for their motors and are running their factory steadily.

Mr. W. L. Arnold, of the Thomson-Houston Company, reports a fairly good business. Among other contracts he has made recently were the following: 100 light machine for the St. Louis Sanitary Company, 31 arc light for a plant at Bessemer, Ala., 650 alternating for Mascoutah, Ill., and a 300 light alternating for Morrellton, Ark.

Belleville, Ill., is working hard to secure an electric road, and has already subscribed $10,000 towards building one. The company who has the franchise asks for $25,000, claiming that the road will cost $85,000, and believes the town should give, at least, the amount asked. The road will be six and one-half miles long, and will operate five motors. The power will be supplied by the Brosius Electric Light Co., of Belleville. The company has a franchise for 20 years, and the town is so anxious to get an electric road that the necessary $15,000 will soon be raised.

The Southern Street Railway, of St. Louis, has won its suit against the Union, Union Depot and St. Louis Street Railway Companies for damages in not being allowed to use the defendants' tracks according to a city franchise, and the court has awarded them $950 damages from each of the three companies. Unfortunately, while they may now extend their line north to Washington street, the franchise calls only for cable or horse-power, and as the Southern is an electric line it will have some difficulty in taking advantage of the right acquired, especially since the mayor refuses to sign a bill allowing them the use of electricity on the extension.

Evidently the local supply men have been roused into taking steps towards securing an organization by the work of the linemen and as a result the St. Louis Electric Exchange has been formed. The object of the exchange is to regulate prices and such business matters as are to the common interest of the electric men, and to be a means towards advancing electric interests of the city. The officers chosen are: R. C. Wolfram, president; Edward E. Cook, vice-president; R. V. Scudder, secretary, and Robert Dodsworth, treasurer. The membership at present consists of the following St. Louis firms: Van Nort Bros., R. Dodsworth & Company, A. C. Wolfram, George J. Percival, Linze Bros., Pierson & Masson, Stagle Electrical Engineering Company, E. T. Cook, Southwestern Electrical Engineering Company, M. C. Garloch, Frank Adams Electric Company, The Southern, St. Louis and Western Electrical Supply Companies.

Two experimental electric roads are soon to be built in St. Louis; one will be on the system of the St. Louis Underground Traction Company and the other on the system of the Unicycle Electric Railway Company. The latter system has already been explained in the REVIEW. A small road of about 100 feet in length is now in operation; the company, however, has received the right from the city to build a trial road two miles in length and work on the new line will soon be commenced. The St. Louis Underground Traction Company is a new St. Louis enterprise. Their scheme is an electric railway run by an underground wire. The plan calls for a conduit similar in construction to that used for a cable line. An insulated electric wire enclosed in a lead pipe furnishes, through brushes placed at intervals along the wire, the current to a long plate attached to the car through the slot. They have a working model now on exhibition and will soon build an experimental road of some length. Mr. G. L. Van Breck is the secretary of the company.

The National Convention of Electric Line and Wire Men of the United States met in this city on Monday, November 23, and was in session until Friday. This convention is the first move to be made towards forming a national association of the different electric line and wire men's unions throughout the country. The delegates from other cities to the convention, 66 in all, were the guests of the local union, who provided everything towards holding the convention. On the Saturday prior to the holding of the convention the local union met and decided on the entertainment of the visitors, and on Sunday, many of the delegates having arrived, a visit to the larger electric plants of the city was made. On Monday, at 10 o'clock, the convention was called to order at Lightstone Hall. After the object of the convention and the line of work to be followed had been discussed, different committees were appointed to attend to the details of the work; Tuesday, Wednesday and Thursday were almost wholly given to committee work, and on Friday the results reached by them were submitted to the convention. The constitution chosen is a very liberal one and provides for the keeping of free libraries and electrical schools by each union, a sickness and death indemnity, and requires as a necessary requisite to membership a three years' experience in electrical work. The name of the association is to be known as the National Brotherhood of Electrical Workers, and it is to hold annual conventions. The officers elected for the ensuing year were: Henry Miller, of St. Louis, grand president; E. Hartung, Indianapolis, first grand vice-president; F. J. Heizleman, Toledo, second grand vice-president; D. J. Finnell, Chicago, third grand vice-president and grand organizer; J. T. Kelly, St. Louis, grand secretary and treasurer. The next convention will be held in Chicago on the second Tuesday in November, 1892. The 66 delegates present represent 29,500 members, of which 19,700 belong to the American Federation of Labor. At this convention it was decided to send delegates to the meeting of the American Federation of Labor, to be held at Birmingham, Ala., in December. These delegates are sent not only as representatives of electric department, but also to forward the interests of skilled electric linemen in securing co-operation in a demand for higher wages. The convention in all was very successful, and if the intentions of allowing other electrical interests to join them and securing a charter are carried out, there is little doubt of its thriving.

St. Louis, Dec. 12, 1891. W. H. B.

Mr. Charles E. Chapin.

Mr. Chas. E. Chapin, of this city, who is well known to the electrical fraternity, has evolved a new idea and will immediately proceed to make a practical application of it. He has taken offices in the Electrical Exchange, 136 Liberty street, New York, and established a general purchasing agency for electrical wares.

Mr. Chapin will act as buyer for central stations, supply houses and, in fact, any one of good standing who is in the market for goods. He has an intimate acquaintance among manufacturers, and his experience as purchasing agent for the Sawyer-Man Company and Alexander, Barney & Chapin, thoroughly qualifies Mr. Chapin for his present undertaking. A full line of every manufacturer's samples will be on exhibition at the agency.

Mr. Chapin is a gentleman of undoubted integrity and ability.

Sprague, Duncan & Hutchinson.

A limited corporation, under the above title, has been formed with offices at 15 Wall street, New York.

Mr. Frank J. Sprague is known as one of the foremost pioneers in electric railway work and is regarded as an expert electrical engineer of high authority on electrical rapid transit. Mr. Sprague has resigned his office of consulting engineer to the Edison General Electric Company, and will devote his attention to the work of Sprague, Duncan & Hutchinson.

Dr. Louis Duncan is well-known as the head of the electrical department of Johns Hopkins University, and is one of the ablest electrical engineers this country can boast.

Dr. Cary T. Hutchinson was Mr. Sprague's assistant in the Sprague Electric Railway & Motor Company, and later was assistant to the chief engineer of the Edison General Electric Company.

Mr. Alfred Bishop Mason is the general manager of the new company.

Sprague, Duncan & Hutchinson, Limited, will conduct a general business as consulting electrical engineers. They will advise municipalities, corporations and individuals as to electric railways, lights and power plants, and render reports to investors and bankers as to the feasibility and probable profits of any project involving the use of electricity.

The ELECTRICAL REVIEW welcomes into the field with pleasure such a high-class company.

PRACTICAL NOTES ON THE REFLECTING GALVANOMETER AND ITS ACCESSORIES.

BY J. D. BISHOP.

IV.

HOW TO SET UP A GALVANOMETER.

This may be one of the simplest and easiest things in the world to do, or it may be one to turn your hair gray. There are some places where the galvanometer may be set down on a solid table, leveled, and be at once ready for work. In other cases, every means you can devise, and all the ingenuity you can bring to bear will fail to secure the steadiness necessary to ensure successful results.

This is chiefly attributable to three causes, viz., unsteadiness of the galvanometer itself, arising from over-sensitive suspension of the mirror; secondly, from vibrations of the ground caused by passing loads; and thirdly, from currents induced by moving masses of metal. The first are always difficult and sometimes impossible to overcome, in which case the best thing to do is to get rid of the galvanometer, or change the suspension.

The second source of trouble may be got over by hanging the galvanometer on a heavily laden board suspended from spiral springs. And the third can only be cured by surrounding the galvanometer by a thick casing of iron. Even after the adoption of all these remedies other sources of trouble may still exist and are absolutely incurable. For instance, there is what may be called a diurnal variation which causes the spot to move to the right or to the left, very slowly and steadily, once between morning and night, and the writer has known one case where the spot of light varied with the high and low tides. This was undoubtedly caused by the ground, which was built up of all sorts of light refuse, being affected by the pressure of the water around it or filtrating underneath it. We trust that the operator will have the good fortune to be able to place his galvanometer on a solid and firm basis, in which case he is to be congratulated. If otherwise, it is left to him to put in practise, or neglect such of the following precautions as the peculiarities of the case may require.

The first thing required is untiring patience and resolute plodding, good humor, and the first thing to do is to see that the galvanometer is clean, free from dust and damp, and that its base and case are perfectly dry, that the leveling screws work easily, and above all, that every connection of the coils and terminals underneath as well as above it are firmly screwed up, for an intermittent contact in the galvanometer is a difficult one to locate and troublesome to rectify.

If the surface of the mirror is damp and clouded, remove it from the coils, being careful not to break the suspension and lay the mirror face upwards (and if astatic, of course, the whole system) upon a piece of chamois leather placed on some hard surface such as a table. Take a strip of clean fine chamois leather and cut a small hole rather larger than the mirror, lay this over the system, so that the mirror fills the hole, cut a piece of stout cardboard in the same manner and lay it on the chamois leather, leaving the mirror exposed. Now cut a piece of chamois leather two inches long and one inch wide, roll it into a tight coil, so as to make a little polisher, with which rub the face of the mirror lightly with one hand while with the other the cardboard is held in place. By this means you avoid all chance of bending the aluminium stalk connecting the two sets of magnets or of breaking the suspension fibre.

If the mirror proves somewhat difficult to clean hold the end of the polisher near a spirit lamp or the heated glass of a gas lamp, so as to dry it thoroughly, with gentle rubbing for a few minutes the stains will gradually disappear; if not, pour a drop of spirits of wine on the end of your finger, moisten the polisher with it, and then rub gently.

It may be as well to note here that the suspension fibre, although apparently so extremely weak, will, nevertheless, stand a good deal of comparatively rough handling, but from the fact of its being almost invisible it is liable to be broken by a sudden jerk or a strain brought upon it in an unguarded moment. Generally there is a small hole drilled at the end of the system through which the fibre is passed and fastened with a knot. The other end of the fibre being tied through a similar hole in the end of the small milled head pin, by which the system is held in place between the galvanometer coils.

As it is very probable that in spite of every care the operator may succeed in breaking the fibre, it is a good precaution to measure its exact length before cleaning the mirror and to carefully take note of this length for future reference. To replace a broken fibre is a delicate and difficult operation, more fit for the gentle fingers of a woman than the clumsy digits of a man; but, with good eyesight, a lady will generally manage to replace one successfully. If, however, the operator is deprived of a lady's assistance, he had better proceed as follows:

From a thread of pure white floss silk pick out a single fibre three or four inches long. The thread should be free from sizing or any stiffening matter. Take an ordinary visiting card and cut a V-shaped notch in it about twice the width of the measured length of the galvanometer fibre. Now take a little fine white shellac dissolved in spirits of wine to the consistency of ordinary office mucilage; lay the system, mirror face downwards, on a piece of white cardboard and fasten it in place by pins driven in, one at each side of the aluminium stalk, and close up in the angle formed by the mirror at one end and the vane or disk carrying the other set of needles. This will generally be found sufficient. At the proper distance from this, as previously measured, fasten the suspending milled head-pin, which is to receive the other end of the fibre. This may be done by placing over it a little strip of paper, fastened down with pins, or preferably, instead of pins, with a couple of drops of shellac solution.

Now take your notched card, and on each prong of the fork caused by the V-shaped notch, put a smudge of shellac; take up the fibre carefully and stretch it across the notch so that it will sink into each smudge of shellac, and put it aside carefully to dry. It is needless to say that all this must be done in a place free from currents of air.

Now, with the end of a needle, take a little of the shellac and lay it on the end of the pin, put a little also on the end of the aluminium stalk. Now take the cardboard with its attached fibre, and bring it carefully over the fastened ends of the system, so that the fibre will fall just in the middle of each spot of shellac, and leave it there to dry. When dry, cut off the loose ends, and hang the whole system up, pin downwards, for a few hours before replacing it in the galvanometer, so that the fibre may become stretched and properly straightened out.

The object of hanging it with the brass pin free is to allow the pin to revolve and so take out any twist there may be in the fibre. If hung by the pin and the mirror allowed to hang free, the directive force of the earth's magnetism and that of the needles would prevent the revolution of the system, and any twists there may be in the fibre would still be retained.

The system being replaced in the coils, level the galvanometer by means of the leveling screws. Galvanometers are generally provided either with two spirit levels, placed at right angles with each other, or with a circular spirit level, the center of its glass cover being denoted by a depression ground thereon. It often happens, however, that when the bubbles in the spirit levels show a true level, the mirror does not hang clear; this may be caused by a slight warping of the base on which the frame carrying the coils is screwed, or either the frame or the stalk carrying the mirror being accidentally sprung or bent in transit. If, therefore, the mirror does not hang clear when the levels show true, it is best to disregard their indications entirely and work the leveling screws according to indications given by watching the mirror. When you have succeeded in making the mirror hang perfectly free, the position of the bubbles may be noted for future reference, which is equally effective with, and a much easier way than re-adjusting the levels. If a sheet of white note paper or cardboard is put up about one foot from and in the rear of the galvanometer, it will be a great assistance in noticing the position of the mirror from the front. Whilst doing this, the directing magnet on the top should be placed as low down as possible, so as to tie the needle down in a direction at right angles to the axis of the coils. If the needles hang perfectly clear, the approach of some weak magnet, such as the point of a penknife, will create a full deflection of the mirror.

Now, suppose everything being ready, the first thing to do is to see if the needles are steady, this cannot be done with the naked eye alone, because the oscillations or vibrations are too small. Take off the directing magnet, trim your lamp nicely and place it about three inches to one side of the axial line of the coils, and about 24 to 30 inches from them. Place a strong reflector behind the lamp in such a position as to throw the light on the mirror. Take a piece of white paper and hold it up about the same distance from the coils as the lamp, so that it may receive the reflected spot of light. When found, move the paper backwards and forwards, and the lamp also, if necessary, until the spot is sharply and clearly defined. If it is somewhat difficult to get a sharp definition, place an ordinary reading magnifying glass about three and a half inches in diameter between the lamp and the mirror, and move it about until the desired sharpness is obtained. The spot once found, note its position on the paper and rule thereon a black lead vertical line, and replace the paper so that the line traverses the center of the spot. The paper may be kept in position by leaning it against a book or other suitable object. Of course, the object of the pencil line is to show in which direction a change of position in the spot of light takes place.

Now, carefully watch the spot; if it remains perfectly still, try the same experiment at double the distance between lamp, paper lens and galvanometer; you will find the spot of light larger, but much fainter and more sharp, and if it remain perfectly steady you may consider your troubles are at an end. But leave things as they are for three or four hours to ascertain whether any change of disturbance may occur owing to conditions not present when you began.

If there is still no deflection you may congratulate yourself heartily, set up your scale and keys and get ready for work.

But, under the conditions that ordinarily obtain in factories, exchanges and electric light stations, it is a thousand chances to one that the mirror will oscillate and vibrate more or less furiously. Generally it does so to such an extent that it is difficult to "catch" the spot on the paper. When this is the case, take a large sheet of white cardboard and try to find its whereabouts. If it is still too widely erratic, take a small sheet of paper, say, a quarter of a sheet of note paper, and hold it close up to the galvanometer, of course, taking care not to obscure the lamp ray falling on it. You will by this means find a small bright spot either appearing on or disappearing from the paper horizontally, or erratically dancing up and down vertically, each of which movements will demand a separate remedy; but probably the spot will perform a series of curves and circular girations interesting to behold but puzzling to account for.

When once found on the smaller piece of paper, take the large piece of cardboard and put it in the same position. Now, keeping your eye on the spot, gradually retire the cardboard from the galvanometer until the movements are so magnified as to enable you to distinctly note their characteristics. It is useless here to attempt to describe the extraordinary movements of a shaky spot, but the observer will probably be able to remark that certain vibrations predominate intermittently at greater or lesser intervals, and with more or less regularity. These will indicate the nature of the disturbing element, and consequently the means which must be employed to counteract it. If the greatest oscillations are horizontal and regular in their extent, notwithstanding the fact that their interval may be irregular, the cause is due most probably to moving masses of iron, such as pullies, fly-wheels, engine shafts, which are working in the vicinity. Passing trollies, tram cars or elevators will produce the same effect, and the observer should look for coincidence between them and the oscillations of the spot.

Now try the effect of replacing the directing magnet on its rod and lowering it to its fullest extent, so as to "tie" the needles down as tightly as possible, the effect of this will be a diminution of the horizontal oscillation, and probably an increase, either apparent or real, of the vertical oscillations, which are the next to be studied.

These evidently must arise from vibrations communicated to the mirror through the framework of the galvanometer.

First of all, try if they originate from the floor. This may be done by walking up and down or stamping on it with more or less force; if the vibrations are increased thereby, one source of disturbance has been found. Next try the table, the bench, or whatever the galvanometer may be placed on. The best way of trying this is to place the hands upon it with more or less weight and with a certain amount of pull in various directions, so that the weight of the body may deaden or damp its vibrations. Note the effect of this. Next see that the cover or case of the galvanometer is either tightly screwed down or is seated firmly and squarely, a single grain of sand or other foreign matter between the bottom of the cover and its seat is sufficient to cause great disturbance by acting as a pivot upon which the cover may balance itself, and swing backwards and forwards to an almost infinitesimal extent. See, also, that the galvanometer itself is firmly screwed to its bed-plate; take care, also, that the rod holding the directing magnet is firmly screwed down. All these are very tedious operations and will severely tax the observer's patience and temper, but in cases of this sort there is nothing for it but intelligence and plodding perseverance.

It is impossible for the writer or any one else to accurately account for or prescribe a certain remedy for the thousand and one vagaries of an unsteady "spot"; but if, after practising all the above suggestions and exercising the fullest capability of the observer, no improvement is obtained, the best way without further to do, is to condemn the conditions at once as impossible for work, and waste no more time about it.

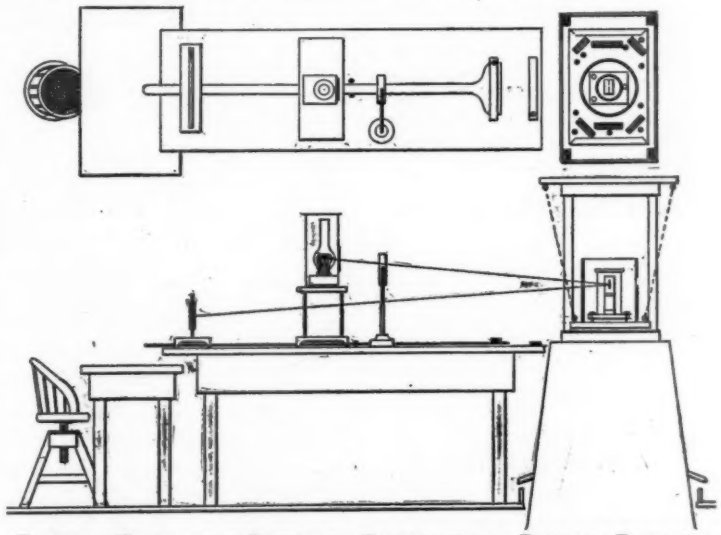
The only remedies left now are to "shield" the galvanometer in a protecting iron case so as to cut off all induced currents, and thus provide an electrical cure, and to hang the galvanometer on springs so as to provide a mechanical cure. There are several excellent ways of doing this, but much will depend upon the design and make of the galvanometer, and here it may be said generally that the cheaper and more home-made the galvanometer is the greater the trouble in fixing. There are many good imitations of first-class galvanometers sold, which, though highly lacquered, beautifully finished and, to all external appearances, exactly the same in form and proportion, are still absolutely lacking in those precautions and refinements of construction which are indispensable to a steady galvanometer. One of these feeble imitations will take days of anxious care and the adoption of every conceivable remedy before a fairly working condition can be obtained, whilst under precisely similar circumstances a good Elliot, Siemens or Carpentier instrument may be simply placed in position, leveled and worked without the least trouble.

If the disturbing influences are but slight, or their effect on the galvanometer only noticeable when excessive, they may be overcome by placing a heavy block of lead about twice the size of the bed-plate of the galvanometer and, say, an inch and a half thick, on four circular columns of soft elastic rubber, about six inches high and two inches diameter. Or the same lead block may be placed upon two strips of elastic rubber, three or four times as long as the block is broad, and which are fastened to suitable uprights so that the galvanometer hangs freely on the two elastic strips.

In this method of suspension the uprights should be wide enough apart to allow the block to swing between them to the extent of an inch or so, and the length of the strips should be such as to allow the galvanometer to hang 10 or 12 inches below the points where the straps are fastened to the uprights.

The object of the heavy lead block is to prevent, by the inertia of its mass, the vibration of the frame-work from communicating itself to the galvanometer. These are absorbed by and lost in the elasticity of the rubber.

Of course, the direction in which the straps are to be extended, whether at right angles to the axis of the galvanometer or parallel thereto, will depend upon the direction of the disturbing vibrations. This, of course, will be left to the observer to discover. But it sometimes happens that this elastic strap suspension will only aggravate the evil when placed in one direction, whereas it will prove a remedy if placed at right angles to it.



PRACTICAL NOTES ON THE REFLECTING GALVANOMETER.—PLAN AND ELEVATION OF TESTING SET.

A very good and steady suspension, if it can be so called, is provided by floating the galvanometer in a suitable tank of oil or water, but this has many objections and is not to be recommended. Another simple means is that of placing a lead block similar to that above described on two or three or four small india-rubber air cushions. These may be bought at any rubber store and should be plain simple cushions with one air chamber only. Another rough and ready, but often thoroughly efficient method of supporting the galvanometer, is that of placing it on a lead slab which lies on the top of a barrel full of fine pine shavings or saw dust, but this is only good as a temporary measure, because the contents of the barrel sooner or later begin to settle and thus throw the galvanometer out.

But the best of all methods of suspension is by metallic spiral springs. In some cases it is sufficient to hang the galvanometer by means of a ring attached to the end of the magnet rod, into which is hooked the end of a brass wire spring, the other end of the spring being hung from a hook let into the ceiling or other suitable support, the spring being kept in tension by the weight of the galvanometer.

The length and strength of the spring will depend on circumstances, but it should be such (and the same rule may apply to all springs spoken of hereafter) that the weight it, or they, may have to bear will stretch them to about twice their length when closed. The single spring suspension has, however, even when suitable, one drawback, namely, the changes of temperature by varying the length causes a circular motion of the spring on its axis, which, although apparently infinitesimal, is, nevertheless, sufficient to create a considerable displacement of the spot and this movement it is very difficult to counteract.

Besides this, whenever it is necessary to alter the directing magnet, the whole system is set in vibration, which causes a considerable loss of time.

The most practical and efficient method of suspending a galvanometer in very shaky places is, according to the author's experience, the following: Provide a well seasoned clear piece of white pine, framed at the ends, about, say, 16 inches wide by two feet three inches long and one inch thick. Into each corner screw four strong screw eyes. This is to carry the galvanometer. Now make a rectangular frame of wood strips set on edge three inches deep by half an inch thick and three inches larger than the above board, to which are strongly screwed four uprights an inch and a half square and four feet high. These uprights are provided with a similar frame at the upper extremity.

The bottom frame should be provided with a stout smoothly-planed floor. The top of this floor and the bottom of the board on which the galvanometer is to be placed should be finished to a dead level surface; so that when one is placed on the other a considerable amount of suction should be felt when pulling them apart. On the upper part of the frame place two small battens of wood over-hanging the narrowest dimension by about four inches on each end. These should be placed about four inches from the outer end of the frame-work. Into the extremities of these over-hanging ends are screwed strong screw eyes similar to those in the galvanometer board.

Now provide four strong springs, about one inch in diameter and two feet long, made of closely coiled brass spring wire, about No. 12 gauge, a couple of the end spirals on each end being turned up at right angles for hooking into the screw eyes. To do this the eyes will have to be opened a little, but this is preferable to using screw hooks, which might catch in the operator's coat sleeve and cause trouble.

Place the completed frame in position, its longest dimension at right angles to the axis of the coils, hang the springs to the top of the frame and the galvanometer board on the bottom of the springs. The bottom of the board will now be about half way up the frame. Now weigh your galvanometer and provide a small bar of lead, say, eight inches long, of the same weight as the galvanometer. Place this in the middle of the board.

It is best to mark this weight so that it may be easily distinguished from others. (Instead of this and the other weights we shall speak of, wooden boxes filled with shot may be used; these will look neater and cleaner than bars of lead, but they are not so convenient to handle.) Now pile on other small bars of lead, about 10 or 12 pounds each is a convenient weight, until the springs are stretched enough to allow the board to come right down almost touching the floor of the frame-work which, by the bye, should have been previously carefully leveled, and, it is scarcely necessary to say, should have a firm unyielding seat. To secure the greatest possible amount of steadiness, the weights should be placed near the springs.

Now, with smaller pieces of lead, adjust the galvanometer board until it lies parallel to the flooring all round, then take two more pieces of lead and place them on the board, so as to bring it fairly down on the floor, taking care, however, in placing all these pieces of lead, to leave room for the galvanometer.

Now remove the piece of lead that you weighed and replace it with the galvanometer. Remove the two extra pieces very carefully whilst an assistant presses the board well down on the floor. By gently removing the pressure, the assistant now allows the galvanometer to rise. This must be done very carefully, for galvanometers are mostly top heavy and if allowed to rise with a sudden jerk it might be upset. Now see if the mirror swings free. It is almost certain it will not, but the final adjustment of level may be made to the most delicate extent by the aid of a few rifle bullets stood on their bases and one or more shifted about until the needle hangs free. The steadiness of the whole suspension will be the greater the closer the galvanometer board is allowed to approach the floor of the frame-work, the thin stratum of air between the two acting as a cushion or a dash pot, which effectually takes up the smaller vibration to which the springs themselves are not susceptible. It will be sometimes found that notwithstanding these precautions a very slight vibration still exists. This may often be overcome by taking a sheet of note paper and bending it in two, not folding it, push the edges between the board and the floor, so that the paper acts as a very slender spring. This paper spring may perhaps increase the trouble, in which case place it between the two on one of the other sides at right angles to its first position; this will rarely fail in securing absolute steadiness. Or, instead of this, remove some of the small weights and allow the board to rise half an inch or so, then with a paper knife insert between the two a small loose roll of fine cotton wool, replace the weights until the board has returned to its original position. This method, however, is not so good as the paper spring.

A Few Pertinent Words from President Mason of the Electric Merchandise Company.

TO THE EDITOR OF ELECTRICAL REVIEW:

In a recent issue of your estimable journal I noticed the prediction that in the near future the "parent companies will handle all, or nearly all, of the electrical supply business." While this may prove true in regard to certain branches with which I am unfamiliar, I ask space in your paper to express my positive disagreement with such views as far as the railway supply business goes.

When electric roads confined themselves to the use of one particular system the chances were that they dealt with that parent company, but at present two, and sometimes three, four and even five systems are used by the same company. In this latter case, the inconvenience of buying supplies from so many different companies is easily conceivable. This condition of things has called forth the exclusive electric railway supply house. With it a road using any and all systems can most profitably do business. Since such a house employs men thoroughly acquainted with all systems and carries complete supplies for the various systems in stock, prompt and accurate shipments are assured, and this fact is highly appreciated by electric roads.

Another thing has brought the electric railway supply house into good repute. Continued consideration of the electric railway has shown that there are certain supplies that may advantageously be employed on all systems, and the tendency has been towards the perfection of such pieces for which the parent companies do not find time, their work being chiefly the manufacture of motors. The result is apparent in the strong, simple and durable material furnished by these supply houses, which, it is generally acknowledged, exceeds in merit the same supplies as manufactured by parent companies.

There is still another feature in the business of the supply house important to street car companies. Undivided attention to the manufacture of supplies has resulted in bringing prices within reasonable limits. When only the parent company which furnished motors could otherwise equip a road it was possible for that company to receive whatever it might ask for supplies. The supply house corrects that evil and furnishes for less money a more serviceable article. Rather than the parent companies absorbing the railway supply business in railway work, the supply house promises to be more and more a desirable and necessary establishment. I am glad to say that one of the parent companies (and I speak of the Edison General Electric Company) appreciates the value of the supply house to itself, and by its protection of such houses does much to encourage them in their particular work.

W. R. MASON.

Chicago, Ill., Dec. 11.

KINDRED INTERESTS

The Burton Electric Heater is the subject of a neat circular sent out by the Electric Merchandise Company, Chicago.

The Central Electric Company, Chicago, have just taken the agency for the Washington carbon and will carry a large stock. These carbons are designed for both high and low tension systems. They give long life and are perfectly straight and uniform. Shipments will be made from the Central Electric Company's stock and at factory rates.

The Jewell Belting Company, one of the largest manufacturers for electric power and electric lighting, sends out one of the most durable of belts in electric power circles. This company has recently secured a number of large orders. No manufacturer in New England stands higher, in point of character and popularity, than the Jewell Belting Company, of Hartford, Conn., and the REVIEW is pleased at all times to chronicle its well-merited success.

The Shultz Belting Company, of St. Louis, Mo., have just sold two woven leather link belts to the Citizen's Electric Railway Company, of Decatur, Ill.; 15 in State of Montana; five in State of Washington; one flat belt, 48-inch double, to Municipal Electric Light & Power Company, of St. Louis, the latter company having been using one of their 48-inch doubles for 19 months; also two double belts to Clinton, Mass.; one 30 inches and 175 feet long and one 36 inches and 210 feet long. The Shultz belt is evidently popular.

The Heisler Electric Company, Philadelphia, reports the following: Carroll Electric Light Works, Matteawan, N. Y. (increase), 600 thirty-two candle-power lights capacity; Messrs. Rheubottom & Bond, Union City, Mich. (increase), 200 thirty-two candle-power; Merced Gas and Electric Company, Merced, Cal. (increase), 400 thirty-two candle-power; Kingman Water and Light Company, Kingman, Kan. (increase), 200 thirty-two candle-power; Glazier-Strong Oil Stove Company, Chelsea, Mich., 200 thirty-two candle-power; Messrs. Cortright & Sons Homer, Mich., 160 thirty-two candle-power. The company also reports an increasing demand for their series lamps for use on arc circuits.

The Crocker-Wheeler Electric Motor Company, New York, have recently furnished a three horse-power motor of their popular perfected type to run a large church organ in Ottawa, Ont. Other late installations of note are a five horse-power special dynamo to the Cornell Electric Company, Hamilton, O.; 125 one-eighth horse-power and 6 one-fourth horse-power, 10 ampere arc motors to a well known firm in Baltimore, Md.; one 1 horse-power to the Alabama Polytechnic Institute, Auburn, Ala., and one 1 horse-power to the Berlin dry-goods store, Brooklyn, N. Y., to run a cash carrier system; besides very heavy shipments to the West Indies and other foreign countries for the Thomson-Houston International Electric Company, Boston, Mass.

To the Toronto Construction and Electrical Supply Company, Toronto, belongs the credit of being the first wholesale electrical supply house in Canada to canvass the entire Dominion by means of capable traveling representatives, who each carry with them several sample trunks filled with samples of the latest and best novelties for electrical uses. At the present time one representative is in British Columbia, another in Halifax, N. S., and four others at various points between the two first mentioned, which are nearly 4,000 miles apart, and as a result of such a progressive policy, the business of the company has increased with great rapidity. All purchases made by the Toronto Company are for prompt cash, and, consequently, they buy to the best advantage.

Pittsburgh Electric Club.

President Mead informs us that the Pittsburgh Electric Club has just leased for five years a fine 11-room house at 802 Penn avenue, Pittsburgh, which will be furnished at once. The Club starts in with 100 members and a large waiting list ready to be acted upon by the membership committee. When entirely completed, the house of the Pittsburgh Electric Club will be the finest in the city, except that of the well-known Duquesne Club.

A Business Man's Hand-Book.

The report of the postmaster-general, just issued, states that nearly $2,000,000 in checks, drafts and money reached the dead letter office during the present year through improper addressing—more than one-half from New York State. Probably double this sum has been lost through delays and accidents resulting from carelessness in mailing and correspondence. To reduce these errors to a minimum, the government issues The United States Official Postal Guide, in an annual number, published in January and monthly supplements, a book of 900 pages, containing three classified lists of the 66,000 post offices in the Union, together with postal rules and mail regulations. Every merchant, wholesale dealer, manufacturer and professional man having correspondence, will find the Guide indispensable It is also of great assistance in translating illegible writings to lawyers, printers and others. No establishment where accuracy and care are observed as rules is complete without it. The price of the Guide in paper is $2.00; in cloth, $2.50. Orders in New York State should be sent to *Home and Country*, 98 Maiden lane, New York; outside of New York State, to Geo. F. Lasher, 1213 Filbert street, Philadelphia, Pa.

PROPOSALS FOR LIGHTS.

The undersigned will receive proposals for lighting the town of Henderson with seventeen 1,200 candle-power arc lights, or their equivalent, for a period of three or five years. Lights to burn every night. Proposals will be received until 12 o'clock M., December 28, 1891. The town reserves the right to reject any or all bids. Lights to be put in operation by the first of April, 1892.

By order of the Board.

J. H. BRIDGERS,
Clerk of the town of Henderson, N. C.

December 7, 1891.

DYNAMO and Motor repairing. Armatures wound for any system, at low prices. All work guaranteed. We furnish new Commutators. Agent for the "Billberg" Motor and Generator.

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Manufacturers of
TROLLEY POLES,
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IF YOU have anything pertaining to electric machinery you want to sell, send us the description.
IF YOU want anything pertaining to electric machinery, send us your inquiries.
FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.

PATENT PERFORATED
ELECTRIC LEATHER BELTING
MANUFACTURED BY
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BRANCHES:
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THE
F. E. BELDEN MICA MINING CO.,
MINERS AND DEALERS IN
MICA.
The Mica of this Company has been put to severe tests and has proved equal in every respect to the best foreign mica, and is for sale at less price,
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Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 13 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 56 in. x 18 ft.; 72 in. x 20 ft.; 108 in. x 22 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 15 in., 16 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.
5 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ½ in. to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.
Send for List of New and Second Hand Machinery in Stock.
PRENTISS TOOL & SUPPLY CO., P. O. Box 3362, 115 Liberty Street, New York.

THE LAW
Double Cylinder Battery.
Surface of negative element and quantity of solution double that found in any other open circuit cell.
Weigh carefully these advantages.

Its sale has steadily increased for ten years.
LAW TELEPHONE CO.,
Sole Makers,
87 JOHN STREET, NEW YORK.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON DECEMBER 8, 1891.

464,490 Electric railway signal; Charles E. Buzzell, Leaf River, Ill.

464,505 Conduit conductor for electric railways; Walter H. Knight, New York, N. Y.

464,510 Automatic fire alarm telegraph; Morris Martin, Malden, Mass., assignor, by mesne assignments, to John F. Nielson, Elizabeth, N. J.

464,513 Electric fare recording system; Barton S. Molyneux, Minneapolis, Minn.

464,519 Spring-jack switch; William R. Patterson, Chicago, Ill., assignor to the Western Electric Co., same place.

464,529 Means for preventing the interference of speech on telephone circuits by induced or other currents; William Stanley, Jr., Pittsfield, Mass., and John F. Kelly, New York, N. Y.

464,540 Time registering device for electrical currents; William D. Wilder and Walter Cobb, Jr., Brockton, Mass.

464,547 Armature winding for dynamo-electric machines; Craig R. Arnold, Philadelphia, Pa.

464,548 Cut-out; Craig R. Arnold, Sharon Hill, Pa.

464,557 Electric railway system; Leon O. Dion, Natick, Mass.

464,595 Lightning arrester; Elihu Thomson Swampscott, Mass.

464,643 Protector for telephones; John L. W. Zietlow, Aberdeen, S. D., assignor of one-half to Francis A. Burdick, same place.

464,655 Electric track signal; Homer A. Parrish, assignor to the Parrish Electric Track Signal Co., Detroit, Mich.

464,665 Secondary battery; Isaiah L. Roberts, Brooklyn, assignor to the Roberts-Brevoort Electric Co., Limited, New York, N. Y.

464,666 Electro-magnetic motor. 464,667 Electrical condenser; Nikola Tesla, New York, N. Y.

464,671 Transformer motor; Otto T. Blathy, Buda-Pesth, Austria-Hungary.

464,673 Drill for electric railways; Harry P. Bradford, Little Rock, Ark.

464,676 Electrode for secondary batteries; Wm. Morrison, Des Moines, Iowa, assignor to the Hess Electric Storage Battery Co., same place.

464,677 Electrical transformer; Arcadius Poleschko, St. Petersburg, Russia.

464,682 Electric arc lamp. 464,683 Electric meter; Addison G. Waterhouse, Hartford, Conn.

464,691 Electric body wear; Lauritz Anderson, Chicago, Ill.

464,719 Incandescent lamp filament; Ludwig K. Böhm, New York, N. Y.

464,730 Electric programme clock; Charles Lester, Chicago, Ill., assignor to George A. Harmount, same place.

464,770 Clamp for electric wires; John J. Green, Boonton, and George C. Brown, Elizabeth, N. J.

464,780 Trolley for electric railways; John W. Schlosser, Washington, D. C.

464,822 System of distributing electricity; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Co., New York, N. Y.

464,897 Telegraph key; Lewis F. Robare, Au Sable Forks, N. Y.

464,933 Process of obtaining metals from their ores or compounds by electrolysis; Charles S. Bradley, Yonkers, N. Y.

464,948 Automatic cut-out for electric motors; Schuyler S. Wheeler, New York, N. Y.

WANTED—The address of manufactories who will make light electric motors of special design for experimental purposes.

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DYNAMOS AND LAMPS.
A number of 15 and 30 light Jenney Dynamos with lamps, price, respectively, $400 and $600. Also four Buckeye Engines, cylinder 15x18, fly-wheel 19 feet by 16 inches face. Disk cranks and automatic cut-offs. Price, $1,000 each, F. O. B. Cars, New Orleans. For particulars, apply to Louisiana Electric Light Company, 52 Union street, New Orleans, La.

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